THE

ELECTRICAL REVIEW.

VOL. LX. MAY 17, 1907. No. 1,538.

ELECTRICAL REVIEW.

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THE ELECTRIC TRAIN ACCIDENT IN NEW YORK.

SINCE we published a note on this accident, *Engineering* has printed a well-illustrated article which deals in a critical way with the reports made by leading American professors for the coroner and the railway company.

The New York Central electric locomotives have been illustrated so often from the time that the first drawings were made, that our readers hardly need to be reminded of the fact that they have four pairs of two-coupled driving wheels, and a pair each of leading and trailing idle wheels mounted in bogie trucks. The function of these pony wheels is to guide the locomotive round curves, and the effect of the leading or guiding wheels is reduced as the speed of the locomotive increases, so throwing more work on the driving wheels, and in particular on the leading outside driver.

These considerations are handled by the experts to prove that the spikes were sheared by the concentration on one driver of the whole load due to the 90-ton locomotive swinging round the curve at 70 miles per hour. There is no actual evidence for this, except that the spike heads were sheared, and that similar spikes under test only sheared after the application of enormous stresses; but there is a suggestion that a rough place in the rail had been reported on the day of the accident, and may have existed when the train was wrecked. Such a defect might cause a concentration of thrust at a point, but it is not likely that it would be confined to one spike only.

The railway company has had to defend itself against the tooth and nail attacks of an ignorant and sensational Press, which insisted that the line was electrified solely for selfish reasons, and without regard to the safety of the public, which would not have been victimised had the steam trains continued to run: the line taken by the defence has been to show that the maximum stresses possible under the worst conditions were well under the ultimate shearing strength of the spikes, and that the stresses were of a higher order with the steam locomotives.

For instance, the railway company's experts arrive at the following figures for the total thrust exerted by the outside leading driver when assuming that the two middle outside drivers do not touch the rail, but including the guiding effect of the pony truck. The locomotive is supposed to be swung round on the trailing driver, as on a pivot, while the trailing bogie plays no part at all.

TABLE I.

Speed—miles per hour		40	50	60	70
Thrust on outer rail ...	lb.	4,740	7,400	10,470	14,130
Weight on outer driver ...	lb.	16,750	17,450	18,605	19,950
Friction resistance due to weight	lb.	4,180	4,360	4,650	5,000
Resultant shear on spike ...	lb.	560	3,040	5,820	9,130

The coefficient of friction between the rail and the tie plate is taken at the usually assumed figure of 0·25.

The calculated resultant shear on the spike is well below the average shearing strength of the spikes tested, but a reduction of the coefficient of friction, such as might have occurred due to ice under the rail, would lower the factor of safety considerably at high speeds, and a lurch caused by a defect in the track might be enough to bring the actual resultant shear beyond the ultimate resistance of the single spike head.

Engineering rounds off the article with a comparison of the calculated effects of the old and new types of engine, and concludes that the steam locomotive, for all its extra weight, has the advantage on account of its higher centre of gravity.

Thus, in the electric and steam locomotives used on this line the loads on the outside leading drivers at various speeds are as follows :—

TABLE II.

Speed—miles per hour		40	50	60	70
Steam locomotive ("Atlantic" type)	lb.	25,165	26,885	32,705	37,695
Electric locomotive ...	lb.	16,750	17,450	18,605	19,950

The frictional resistance, therefore, between the rail and tie-plate is considerably greater in the case of the steam locomotive with the high centre of gravity.

Taking the figures given by the railroad company, we have for the steam locomotive, so far as the leading driver is concerned :—

TABLE III (compare with Table I).

Speed—miles per hour		40	50	60	70
Thrust at leading outside driver	lb.	6,120	7,450	11,230	15,390
Friction resistance due to weight on wheel...	lb.	6,280	6,720	8,170	9,420
Resultant shear on spike...	lb.	—	730	3,060	5,970

The leaning towards the steam locomotive, which *Engineering* may be supposed to have, does not deter it from adding that these calculations do not take into account the extra stresses which are due to reciprocating and partially balanced moving parts, nor, it might be added, to the lurching which may be caused directly by the higher centre of gravity.

For as long as this accident is remembered, there will be more than one opinion as to the cause of it, and the nature of the case forbids any nearer approach to the truth than the choice of a batch of conjectures, but it cannot be doubtful that similar accidents may be prevented by attaching the rails to the ties, so that the factor of safety of the fastenings is six or ten times in excess of the calculated stress which may be concentrated under the worst combination of conditions conceivable upon any one fastening.

Rather late in the day, the New York Central has double-spiked the rails.

Cable by Preference.

A SERIES of well-written articles has been published in the *Morning Post* of May 4th, 6th and 7th, on the subject of State-owned cables, and in the proceedings of the Imperial Conference Mr. Lloyd George, the President of the Local Government Board, in reply to the first part of Sir Joseph Ward's practical proposal, viz. :—(1) "The Improvement and Cheapening of Cable Communication with this Country," stated that "it would be an undoubted advantage if traders could communicate their orders quickly and at rates which would not be prohibitive," and that the acceleration of Inter-Imperial communication was a thing by which all would benefit. His Majesty's Government had had no concrete scheme submitted to them, and the problem was complex and difficult, but he believed it was not beyond the resources of British statesmanship. It would, perhaps, not be too much to ask Mr. Lloyd George to examine what has been written upon the subject of Imperial Cables. Their advocacy extends over a period of years that many of us would like to have returned, but there is no doubt that there exists enough matter to supply anyone with a concrete knowledge of this subject if he wished to materialise it.

Attention has been called in the article in the *Morning Post* of May 7th to the diminishing share now being paid by the partners in the Pacific Cable. We have referred to this in our previous issues, but still we maintain that, given a capital outlay of no more than is required for a cable, its equipment, maintenance and working, Government systems should be able to pay their way and put aside sufficient to duplicate lines as soon as possible, as private companies have done. It is therefore a very important matter, greater than any other consideration, that first outlay should be as low as possible, having regard to efficiency; and the fullest knowledge to attain this must be with the direction of the work, if success and not a continual drain on the public purse is to follow. All "indirect" benefits to be looked for—and these are many—should come with the profitable working of the enterprise, whether it be a State or a private one.

Foreign Governments are making successful efforts to obtain for themselves routes free of control, and it would naturally follow that the British Government with the Colonies should at least secure one route to themselves.

Since the above was written, the resolution of the Cape Colony on the subject of Imperial cable communication has been passed as follows :—

1. In the opinion of this Conference the provision of alternative routes of cable communication is desirable ; but in deciding upon such routes the question of the strategic advantage should receive the fullest consideration.

2. That landing licences should not operate for a longer period than twenty years, and that when subsidies are agreed to be paid they should be arranged on the "standard revenue" principle, *i.e.*, half the receipts after a fixed gross revenue has been earned to be utilised for the extinguishment of the subsidy, and, by agreement, for the reduction of rates.

Manufacturing Processes and Scientific Societies.

LOOKING over the published proceedings of a large number of scientific societies, one cannot but be struck with the fact that most of the papers contributed deal with abstract questions of theoretical interest. Others are concerned with a description of a specific performance, such as a piece of engineering construction or interesting research. But, excepting that of the Iron and Steel Institute, the literature of scientific societies is singularly deficient in the practical details which make all the difference between success and failure in manufacturing operations.

Even a young and virile body, such as the Faraday Society, cannot free itself from this reproach. A paper presented at a meeting in February dealt with the electrolytic alkali and bleach industry. The subject was one of considerable interest to engineers and to electrochemists generally. To the former there was suggested the idea of electric power generation and consumption on an absolutely steady load giving a 100 per cent. load factor : yet nothing was given in the paper as to the cost of electrical energy under such circumstances. To the latter there was suggested a multiplicity of questions, such as the life of carbon anodes, and the rate of disintegration at specified current densities, or the life and construction of diaphragms in electrolytic processes employing these devices. Nothing, moreover, was said as to the fuel expenditure in evaporating the alkaline liquors for the production of caustic soda. All these questions are matters of general interest to electrochemists, but no information is forthcoming from the very reticent manufacturer. In the discussion which followed the paper to which we allude no manufacturer joined.

While the general reticence of the manufacturer is to be regretted in one sense, it is easily explicable. Patent specifications (whence much technical knowledge—or what passes for it—is culled) do not cover aught but broad principles as to processes. Constructional details in practice and methods of operation are not patented. At the same time it is upon these minor points, regarded as an aggregate, that success or failure depends, and a disclosure of these, or of a method of applying any material purchasable by all in the open market, would often enable rival firms to tune up their methods to such a degree as to make competition harder for the successful manufacturer—hence his reserve.

THE ROYAL SOCIETY CONVERSAZIONE.

THE first Royal Society conversazione of the season was held at Burlington House on the 8th inst. There were few, if any, exhibits of apparatus representing inventions that may be looked upon as epoch-making. Mr. Louis Brennan's mono-railway may be reckoned as one of the few, though its great scientific and technical interest is no guarantee of its ultimate commercial success.

The Brennan mono-railway is a tight-rope railway, in which the carriage running on the tight rope is balanced by means of two gyroscopes revolving in opposite directions. In order to bridge a chasm or a river, all that is necessary is to stretch a steel cable across it, on which the gyroscopic carriage will run with perfect safety—so long as the gyroscopes keep on running.

Models were also exhibited by Dr. Otto Schlick and Messrs. Swan, Hunter and Wigham Richardson Ltd., of the application of the gyroscope to prevent the rolling of ships at sea.

Mr. Duddell exhibited his apparatus for producing persistent electric oscillations, which has recently been playing so important a part in connection with wireless telegraphy and telephony. As is well known, the Duddell invention (which, though anticipated by Prof. Elihu Thomson, was independently made) consists in arranging a circuit containing capacity and self-induction, in shunt with an electric arc. Under these conditions, persistent oscillations are excited by the arc in the shunt circuit. Poulsen has recently discovered that the frequency of such oscillations is immensely increased by placing the arc in an atmosphere of hydrogen or coal gas. Experiments in magnetic induction, tuning, and discharge in vacuo were demonstrated by Mr. Duddell with his apparatus.

Col. Crompton exhibited a measuring machine designed to combine accuracy with rapidity of working. The accuracy obtainable is greater than 1 in 200,000, and the tests can be made at the rate of one per minute. The end pressure is obtained by a spring and electric contact. The accuracy is due to the extreme solidity of construction, and a 100-thread per inch screw 4 in. long in the nut, which is corrected by a spiral profile device.

Sir James Dewar had an exhibit to show that the motion of the Crookes radiometer was arrested in very high vacua, such as that produced by charcoal cooled by liquid hydrogen, or liquid air. No movement was observed when the instrument was subjected to the concentrated radiation of an electric lamp.

Some curious phenomena, apparently based on the same principle as the radiometer, were shown by Dr. Bottomley, and by Mr. F. A. King. The apparatus exhibited consisted of a "radium clock" and various types of vacuum electroscopes. The vacuum electroscopes are set up to show the effects of radiations from sources of heat and light upon gold leaves hanging within highly exhausted enclosures. The gold leaves of the vacuum electroscope diverge when illumination of any kind falls upon them, and stand permanently apart when placed in bright daylight. By suitably manipulating such sources as a spirit flame, candle, or Nernst lamp near the electroscope, forces, which vary in direction and magnitude from point to point within the enclosure, are generated, and cause the leaves to be twisted into curious shapes. The gold leaves remain in this contorted condition for a considerable time after the exciting cause has been removed.

The Cambridge Scientific Instrument Co. exhibited Prof. Féry's self-contained radiation pyrometer. This pyrometer utilises the heating effect of the "total radiation" from a hot body, focused as an image of that body by means of a concave mirror. It differs from the already known Féry radiation pyrometer in being entirely self-contained, the image falling on a minute bi-metallic flat spring (Breguet spiral). This becomes partially uncoiled as its temperature rises, and a light pointer attached moves over a dial divided to give direct temperature readings.

The same company also exhibited the universal portable electrometer, designed by C. T. R. Wilson, F.R.S. This is a gold-leaf instrument, with very small capacity and fused quartz insulation. It is suitable for work on atmospheric electricity, radio-activity, &c., and is self-contained, with means for standardising the readings, which are very steady, even in a fairly high wind.

The importance of short exposures in taking X-ray photographs of the human subject was illustrated by an exhibit by Dr. Robert Knox and Mr. G. Pearce. These gentlemen, by using a specially powerful coil and a tube adapted to take a large current, have succeeded in getting photographs of parts of the human body with exposures of 1 to 5 seconds. The sharpness of organs which are usually in motion, such as the lungs, is consequently much improved. The instruments employed to produce skiagraphs, with exposures varying from 1 to 7 seconds, consist of a powerful induction coil yielding a greatly intensified secondary current, worked in conjunction with an electrolytic interrupter directly from high-voltage electric light mains. The core of the coil consists of transformer plates. The primary is of a much larger wire than usual, and has more turns. The secondary is much smaller than usual, and has more turns. The X-ray tube is provided with a heavy anode to withstand the current. In series with the X-ray tube a rectifier is placed to render the current uni-directional.

Dr. F. D. Chattaway, F.R.S., had an interesting exhibit of copper mirrors produced by depositing copper on glass from an aqueous solution. In the mirrors exhibited the copper had been deposited upon the glass by reducing cupric oxide by an aqueous solution of phenyl hydrazine in presence of potassium hydroxide, which accelerates the action to a remarkable extent. The mirrors are equal in brilliancy to silver mirrors, and on account of the colour of the copper are much more beautiful.

THE TEMPERATURE COEFFICIENT OF GUTTA-PERCHA.

IT has been usual to assume a regular variation in the temperature coefficient of the insulation resistance of gutta-percha used in cables. Fig. 1 (curves 2, 3, 4 and 5, p. 792) shows typical curves of this coefficient used for reducing the resistance measured at any temperature T to the value at the standard temperature of 75° F. The measured resistance has to be divided by the coefficient corresponding to temperature T. For convenience in comparing the shapes of the rising and falling branches of the curves, the reciprocals of the values of the coefficient for temperatures above 75° have been plotted in place of the actual (fractional) values.

The curves will be seen to be approximately asymptotic for low temperatures, and on this assumption the values of the coefficient for the freezing point have usually been calculated without actual test.

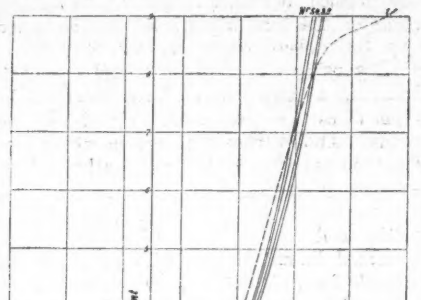
Recent experiments have, however, shown that this assumption for temperatures close to the freezing point is far from justified, and Herr K. Winnertz, in the *Elektrotechnische Zeitschrift*, publishes some useful test results on the point. He obtained the following figures for the coefficient by taking measurements at 5° intervals from 32° F. to 95° F., the latter being the highest temperature which has to be dealt with, even in the case of cables laid in the tropics.

Deg. F.	Coefficient.	Deg. F.	Coefficient.	Deg. F.	Coefficient.
95	·1415	74	1·089	53	6·015
94	·1561	73	1·187	52	6·373
93	·1721	72	1·293	51	6·722
92	·1898	71	1·409	50	7·057
91	·2105	70	1·535	49	7·377
90	·2332	69	1·672	48	7·670
89	·2574	68	1·821	47	7·943
88	·2836	67	1·984	46	8·178
87	·3125	66	2·161	45	8·383
86	·3444	65	2·353	44	8·499
85	·3813	64	2·562	43	8·585
84	·4304	63	2·790	42	8·637
83	·4801	62	3·035	41	8·678
82	·5251	61	3·302	40	8·719
81	·5848	60	3·588	39	8·757
80	·6458	59	3·896	38	8·796
79	·7066	58	4·223	37	8·834
78	·7707	57	4·564	36	8·880
77	·8406	56	4·919	35	8·932
76	·9168	55	5·282	34	8·990
75	1·000	54	5·650	33	9·053

These figures are plotted in the dotted curve 1 in fig. 1, and show a characteristic bend at about 45° F.

D

The magnitude of the error introduced by using the ordinary curves 2 to 5 in place of the true curve 1 can be best shown by an example. Suppose the insulation resistance



Temperature Coefficient of Gutta-Percha.

of a certain cable is found to be 3,000 megohms at 40° F., and 3,074 megohms at 35° F. The coefficient for obtaining the resistance at 75° F. from the 40° F. resistance is—

Curve 1 = 8·719
Curve 2 = 13·02
Curve 5 = 15·77

and for obtaining it from the 35° F. resistance it is—

Curve 1 = 8·932
Curve 2 = 18·97
Curve 5 = 23·39.

Using these figures, the resistance at 75° F. works out at—

344·1 megohms by curve 1
230·5 megohms by curve 2
190·3 megohms by curve 5

on the basis of the 40° F. measurement, or—

344·1 megohms by curve 1
162·1 megohms by curve 2
131·4 megohms by curve 5

on the basis of the 35° F. measurement.

The curve for temperatures above 75° F. is more regular than for the lower temperatures, and appears to become asymptotic. The actual values of the coefficient depend, to a certain extent, on the quality of the gutta-percha used, but large variations are not likely to occur.

Electric Power in Durham Collieries.—In connection with the illustrated article which appeared under this heading in our issues of April 26th and May 3rd, we stated that Messrs. Bruce Peebles were contractors for the whole of the electrical equipment, inadvertently omitting the concluding words, *here described*. As a matter of fact, the Lambton Collieries contract was divided, Messrs. Bruce Peebles carrying out the contract for the equipment of the Margaret, Lumley, "D," and Lady Anne Pits referred to in the above-mentioned article, and Messrs. The Electrical Co. the contract for the Herrington and Dorothea Pits and the Philadelphia works installation. We are also asked to point out that the Sirocco ventilating fan, referred to as delivering 145,000 cubic feet of air, &c., actually uses only 73 H.P. for that duty, although driven by a 125-H.P. motor.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Balancers.

The article on balancers in your recent issue should be read with interest by everyone having charge of this class of machinery, whether for public supply, traction, or workshop use. It would be well if consulting engineers were more conversant with the practical side of this question, and would see that not only was the proper type of machine specified, but that it was coupled up correctly also, a point which may readily be overlooked, and one which is giving more trouble than "badly designed" machines; here I beg to differ from Mr. Taylor, not having found stock-shunt or compound-wound machines, make bad or indifferent balancers when correctly coupled up.

Thinking that, perhaps, my experience in this line might be of some use to your readers, I venture to give the following particulars of a recently installed plant:—

The present balancers were ordinary belt-driven compound-wound 50-KW. dynamos; on raising the voltage to 400, they were no longer required, and being like machines, I conceived the idea of making them into balancers; accordingly the third bearing was taken away, the shafts shortened and fitted with a coupling, the bed having been shortened and planed up, the whole was mounted together, and the field connected up as per diagram, which will be found to agree with Mr. Taylor's fig. 5. The machine balanced perfectly from no-load to 300 amperes without shunt regulation. The power house in which they are working, contains two 250-KW. compound-wound generators and one 400-KW. shunt ditto.

Shortly after finishing the above, it was found necessary to put down more generating plant, and three-wire compound-wound 500-KW. machines, with slip-rings for balancer, were decided upon, each to be capable of dealing with 25 per cent. out-of-balance current. As these are for the adjacent shops (the power houses being ½ mile apart), they are

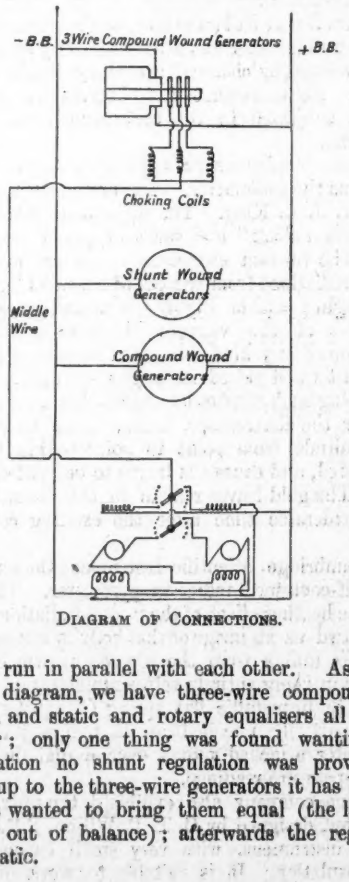


Diagram of Connections.

arranged to run in parallel with each other. As shown on the wiring diagram, we have three-wire compound-wound, plain shunt, and static and rotary equalisers all connected up together; only one thing was found wanting—in the first installation no shunt regulation was provided. On connecting up to the three-wire generators it has been found that this is wanted to bring them equal (the latter being 1 per cent. out of balance); afterwards the regulation is quite automatic.

E. D.

Income-Tax and Depreciation.

Mr. Hammond, in his letter in your last issue, states that he has found by experience that the most divergent views exist on the part of rating authorities with respect to the amount of depreciation which should be allowed on electrical undertakings when assessing for income-tax.

He gives an example of an undertaking of a capital value of £10,000, and states that a fixed sum should be allowed, actually representing the average depreciation for one year, sufficient to wipe off the value of the plant in 25 years.

Whilst there is great difference in the amount of the allowances made for depreciation by surveyors in different towns, there is also a divergence in the method of allowing the depreciation—*i.e.*, taking Mr. Hammond's example, some surveyors would allow the 4 per cent. (£400) each year for 25 years, when the whole £10,000 would be wiped off; whilst others would allow the 4 per cent. on the reducing balances only.

The allowance, if made on the "reducing balance" principle, would be £400 for the first year, and in the second year 4 per cent. on £9,600, or £384, so that each year the allowance would become less and less, and the original capital would take a correspondingly longer period to become extinguished.

Any new capital expenditure that may be incurred year by year is added to the reduced balances.

Weighty arguments can be put forward in support of this latter method of allowance, and several appeal cases against the assessment of ships, &c., apparently support it, and the object of my letter is to ask Mr. Hammond, and any other experts who may have had to do largely with assessment appeals, to give their opinion on the above system, more particularly as to whether it could be upheld in the case of electrical undertakings.

John Pilling.

King's Lynn, *May 13th*, 1907.

Fancy Names for Lamps.

I have been interested in this correspondence, but it seems to me that only the fringe of a large subject is being dealt with.

It is certainly a source of annoyance to find lamps placed on the market with all sorts of fancy names, and as fancy claims made for them, while no indication of the watts consumed is given, but it is quite as great an annoyance to find that the ordinary 16-C.P. lamp of commerce carries a lie stamped on its very face, not only in current consumption, but in candle-power and voltage also at times. It is manifestly impossible for manufacturers to turn out lamps with a machine-made accuracy, but they might try to supply within reasonable limits, and I would suggest that the limits within which their lamps are guaranteed should appear in the lists they issue.

But how much does the term 16 C.P., when applied to a lamp, indicate to any one except in a relative sense? It is not a measure of the mean spherical candle-power, nor does it accurately measure the value of the candle-power given by the lamp at every point in the horizontal plane passing through the filament loop, and hence it is only of use as a very rough relative guide by which one lamp may be compared with another.

Consequently makers ought to give polar curves of candle-power distribution in one horizontal, and two vertical planes, for their various standard types of lamps, and guarantee that these curves should be correct to within a reasonable percentage. The increasing use of lamps backed by reflectors makes this matter more urgent, as great increases of downward illumination may be obtained by means of reflectors from what might otherwise be very inefficient and wasteful lamps. Sometimes, indeed, one finds the efficiency of such a combination stated in terms of the vertical downward candle-power; this is a most misleading and pernicious system, as it is too often used to cloak a wasteful illuminant. I am pleased to note that the Linolite Co. adhere "strictly" to the standard efficiency of 3·75 watts per candle-power; that is as it should be.

John D. Mackenzie.

Glasgow, *April 30th*, 1907.

Of Dogmatism in Science.

I quite agree with your contributor, "W. M. M.," that the difference between us is simply one of definition, but if he admits that the velocity of propagation of the electromagnetic wave is $1/\sqrt{\mu K}$, he must also admit that the definitions he adopts for μ and K are inconsistent with one another. For in order to interpret the velocity equation, he finds it necessary to discard both electrostatic and electromagnetic systems of units, and, in fact, to throw over all C.G.S. systems, inasmuch as he has to adopt $1/3 \times 10^{10}$ seconds as the unit of time (p. 621). He is then able to say that the velocity $1/\sqrt{\mu K}$ for air is 1 centimetre per $1/3 \times 10^{10}$ seconds. The velocity of propagation of an electromagnetic wave is, of course, quite independent of the size of the units used in measuring it, and definitions which compel the adoption of outlandish units do not appeal to me. I prefer to follow Maxwell.

Considering the subject of the correspondence, however, neither my views of the correct definition nor those of "W. M. M." are to the point. The question is, what is to be taken as the official view of scientists? I believe that those best entitled to express this view, such as Profs. Larmor and J. J. Thomson, would be found to agree substantially with Maxwell in the matter, and unless "W. M. M." can show that the views he puts forth are more generally accepted, he should have headed his article differently.

I would not, however, be understood to be belittling the value of the article, which should be helpful to students on a matter that is very inadequately treated in text-books. I merely suggest a change of title.

F. W. Carter.

Rugby, *May 7th*, 1907.

PARLIAMENTARY.

Radio-telegraphic Convention Committee.

At the resumed sitting of the Committee on Tuesday, May 7th, Sir J. Dickson-Poynder, Bart., presiding, the first witness was Sir William Preece, K.C.B., late engineer-in-chief to the Post Office.

Replying to the Chairman, the Witness said he had worked at wireless telegraphy for 12 years before Mr. Marconi came to England. He claimed that the Post Office had made wireless telegraphy free and open to the world.

Can you see any serious objection to the Convention being ratified?—I think it would be a very serious evil to this country if that Convention were not ratified.

Continuing, Witness said it was absolutely essential that they should have free trade in wireless telegraphy, because they wanted as much as they possibly could to encourage small ships to use the system. The Convention would break down to a certain extent the monopoly that the Marconi Co. were endeavouring to secure, and it would lead to the organisation, and the regulation, of all the wireless telegraphy business of the world. He did not see why there should not be intercommunication between the different systems. In its present form the Poulsen system could not intercommunicate with the Marconi system, but it might be very easily made to do so. He believed in the possibility of communicating between England and the States by wireless telegraphy, but he did not believe that it would ever be done on a commercial basis. He regarded wireless telegraphy as supplemental to submarine cables. It cost more to work a wireless telegraph system than a cable—the installation costs were not so great, but for the purposes of wireless telegraphy they must have an expert at each end, and that cost money. He had seen Mr. Marconi's evidence, and he had noticed some of it with a little surprise. He referred only to the length of the wave and the amplitude. With such a coherer as Sir Oliver Lodge's, there was no difficulty in picking up any wave lengths. The introduction of the amplitude would be most confusing, and would be of no use whatever. To define the energy and the wave-length was all that was required. Mr. Marconi was apprehensive that the Convention would stifle progress and suppress experimental stations, but he could not accept that at all.

By Mr. Lee: He had formed the conclusion that the Marconi Co. was the worst managed company he had ever had to deal with. As to its organisation, they quarrelled with everybody.

The Chairman: What in your view would be the position of Great Britain if the Convention is not ratified?—I think we should be the laughing stock of the whole world, and we should throw into the hands of those who are now striving to get the business practically all the wireless telegraphy of the world.

Questioned as to whether Mr. Marconi did not say that he had no objection to licences being granted to other companies, Sir William said he believed that Mr. Marconi did agree with free

competition, but Mr. Hall did not. He did not agree with Mr. Marconi that as systems developed the difficulties of inter-communication became greater. The Poulsen system he regarded as a great step in advance, and in the future he believed all systems would work by persistent currents. At the present time the Poulsen system was in an experimental stage.

Answering Mr. LEE, Sir WILLIAM PREECE said that when he referred to the inefficiency of the Marconi Co., he meant in the development of its commercial and business side—not in the actual conduct of its business. He had every reason to believe that the business, as from ship to ship and ship to shore, was very well managed, and its organisation in that respect was very highly efficient.

Dr. J. A. FLEMING, F.R.S., handed in a statement to the Committee, in which he said he had made the subject of electric wave research a speciality. In 1899 he was invited by Mr. Marconi to act as scientific adviser to his company. He assisted Mr. Marconi in the design of apparatus for the first power station in the world for long-distance wireless telegraphy, and was intimately acquainted with his work, as well as that of other inventors on this matter. It was Marconi who first made electric wave telegraphy of practical use, converting a mere laboratory apparatus into a telegraphic appliance. However much Mr. Marconi might have benefited by the work of his predecessors, the fact remained that whilst, before his work in 1896, there was no electric wave telegraphy, since that date it had gone forward with giant strides, and there had been a flood of inventions, patent improvements, and research, starting from his fundamental improvements. The modifications which had been introduced were in details, not essential principles. The more recent forms of transmitter differed from the earlier only in the number and energy of the waves sent out at each discharge spark. In the most recent forms of transmitter the trains of waves were continuous, or nearly continuous, and did not die away at all. They were called undamped waves, and there were three methods of creating them: (1) a mechanical method by means of a high frequency alternator; (2) the electric arc method due to Duddell and improved by Poulsen; and (3) a mechanical and highly effective method which was a recent invention of Mr. Marconi—and which he (Dr. Fleming) thought would exhibit a great advanage over the arc method, at least for large powers. The antenna, which was used for the reception of undamped waves, could be made still more selective in its action as compared with the feebly damped receiving antenna, but it then required more skill to keep its corresponding transmitter in tune with it. There were thus three characteristic qualities of the electric waves used in telegraphy—viz., wave length, wave energy and damping. Those corresponded to the tone, loudness and duration in the case of sound signals. In the regulations of the Berlin Conference the last two qualities were entirely ignored, and waves differentiated merely by wave length. That was quite unscientific. Another matter to which he wished particularly to draw the attention of the Committee was the difficulties which surrounded electric wave telegraphy arising from the ever varying transparency of our atmosphere to Hertzian waves. Under some conditions, transmitters of small power would send messages over unusually great distances, under others, transmitters of large power were curiously limited in their range. That altogether vitiated the calculations of those who thought that there was a hard and fast limit to the sphere of influence of any one transmitter. All those things supported the conclusions that electric wave telegraphy was still a young art. The notion that it had arrived at a final, practical state, in which it might very suitably be subjected to regulations for the good of all, was a complete fallacy. Electric wave telegraphy had, moreover, this peculiarity on which he wished to lay very great stress, viz., that experiments for its improvement could not be carried out on a small scale. To make any useful invention in it, each idea must be tested for some time in real, practical telegraphic work. No small scale or laboratory experiments sufficed. To overcome the difficulties of trans-Atlantic telegraphy, we must experiment across the Atlantic. It was not the slightest use to try the proposed methods across the English Channel. Wireless telephony, or the transmission of speech by electric waves, had made more than a beginning, and he had the strongest belief that the problem of trans-Atlantic telephony was not only soluble, but quite practicable. At this stage of the development of a progressive, but infantile and yet important art, the proposed international regulation of it amounted to a suggestion to put a lusty infant into a close-fitting suit of armour, the ostensible purpose of which was to increase its usefulness, but the real effect of which would be most certainly to stop its growth. To show that this was not an imaginative fear, Dr. Fleming pointed to the history of electric lighting in this country, premature legislation for which had, he said, crippled the industry. Regarding interference, the important question was whether the overhearing was voluntary or involuntary. The remedy of the Convention was to define the wave lengths to be used in commercial work, and reserve other ranges for naval, and others for trans-oceanic work. There were no regulations limiting the damping or the maximum wave energy in a train which might be used, yet a station emitting a powerful, strongly-damped wave of legal wave length was a far greater offender and nuisance than a station sending out a wave not of correct legal wave length, but less maximum energy and feebly damped The real danger was not the growth of a monopoly, but the artificial restriction of the development of an art of the greatest importance to the world. Mr. Babington Smith had suggested that if England refused to ratify, the Convention, Continental wireless telegraph corporations might engage in international disturbance. If, however, they were to do so, they would simply destroy their own field of operations. He regarded the idea of a wireless war as entirely hypothetical, and not within the range of practical politics. If we assumed that other nations ratified the Convention while England did not, England would be even in a better position for avoiding disturbances than if she ratified it, for the nations that ratified would be bound by the regulations of the Convention to use certain wave lengths, and not to use greater power than was necessary to effect communication. It would then be the simplest thing in the world for the British stations to select other wave lengths which did not interfere with the Convention wave lengths. The Committee adjourned.

Sheffield Corporation Bill.

LORD LUDLOW'S Select Committee of the House of Lords commenced on Thursday last week the consideration of the Sheffield Corporation Bill, which deals with water, tramways, and other matters. The promoters were represented by Mr. Balfour Browne, K.C., and Mr. Vesey Knox, and amongst the opponents were the Yorkshire Electric Power Co., represented by Mr. Freeman, K.C., and Mr. Simney.

Mr. BALFOUR BROWNE, in the course of his opening speech, said that in 1872 tramways were constructed by a company, but these were now in the hands of the Corporation. The Corporation also carried on the electric lighting undertaking and had expended £860,535 upon it. The Corporation were now proposing to make nine additional tramways, and to run omnibuses in and outside the city—feeders to the tramways. With regard to their electricity undertaking, the Corporation were asking for power to supply in bulk and to individual consumers in the districts abutting on the city, as it was found that there were a number of works just outside the city which wished to obtain a supply. Both the Yorkshire Electric Power Co. and the Nottinghamshire and Derbyshire Electric Power Co. had powers to supply the districts which the Corporation sought to supply, but it was owing to the impossibility of obtaining such a supply from these companies that caused the manufacturers to ask the Corporation to supply them. The Yorkshire Co. had a generating station 30 miles away, but the other company had no generating station anywhere near. His submission was that the Yorkshire Co. ought not to be allowed to appear against the Bill, because they had no monopoly of the district, and it was obvious that they could not supply from a generating station 30 miles away without great expense.

On Friday, counsel on behalf of the Rotherham and Doncaster local authorities intimated that they would withdraw their opposition to the electricity part of the Bill if the promoters agreed not to supply electricity in their area.

Mr. RAM, K.C., on behalf of the promoters, gave this assurance.

Alderman R. STYRING (Lord Mayor of Sheffield) was then called, and bore out the opening statement of counsel.

In cross-examination by Mr. FREEMAN, WITNESS said that while it was true that the Yorkshire Power Co. had the right to supply in the area now sought to be supplied by the Corporation, yet it was not an exclusive right. It was true that in the company's Bill the Corporation obtained a clause prohibiting the company from coming into Sheffield without the consent of the Corporation.

Mr. FEDDEN, manager of the Electricity Department of the Corporation, also gave evidence in favour of the Bill, and in reply to Mr. FREEMAN, said that the manufacturers who asked the Corporation for a supply did so on their own initiative. The justification for the Corporation asking for these powers was that no other persons could supply at so economical a price.

Mr. FREEMAN addressed the Committee on behalf of the Yorkshire Power Co., and contended that the Corporation ought not to be granted permissive powers to supply in the district of the company.

Mr. WOODHOUSE, engineer to the Yorkshire Power Co., was examined by Mr. SIMNEY, and said that the company had a station at Thornhill, which was about 20 miles away from Sheffield. They had other stations in contemplation for erection. The progress of the company had increased very considerably during the last year or so. In 1906 the output was 400 per cent. over that of 1905, and it was steadily improving. They were steadily occupied in laying new mains, and they now had something like 90 miles of mains in various directions. They had some five or six sub-stations, but none in the direction of Sheffield. He did not think there was any economic difficulty in supplying customers near Sheffield, for they would charge the same price as for consumers near the power station. Cross-examined by Mr. RAM, witness said it would cost them £500 per mile to lay a main above the ground, and about £1,000 a mile underground. The main would be 1,500 H.P.

Mr. RAM replied on behalf of the Corporation, and said that the whole case for the promoters was whether the requirements of the firms were to be refused on account of the Power Co.'s Act of 1901. They only asked to supply these particular firms, and he hoped the Committee would allow that.

The Committee found the electricity part of the Bill not proved.

Mr. RAM pointed out that one firm proposed to be supplied was in the area of the Nottinghamshire and Derbyshire Co., but that company had raised no objection to the proposal, and he asked if the decision of the Committee would stop them supplying that particular firm.

The CHAIRMAN: We find the preamble of the Bill not proved so far as the Yorkshire Power Co.'s area is concerned.

New Committee.—A new committee of the House of Commons has been appointed to consider the Central London Railway, the Manchester Corporation Tramways, the Lower Thames Tunnel Railways, and the Oxford and District Tramways Bills.

The L.C.C. Electric Supply Bill.

In the House of Commons on May 9th, there was a lengthy discussion, which was not concluded when the House rose, on the above measure. A very full report of the speeches appeared in the *Times* of May 10th, to which we may refer our readers. According to the *Times* summary Mr. Courthope moved the rejection of the measure, the chief objection which he took being that it would enable the County Council to increase the indebtedness of London to an extent almost unlimited. Further, to grant the powers asked for would be to encourage municipal trading in its worst form. Much hostile criticism came from the Ministerial side of the House, it being directed against the leasing clause in the Bill. Some speakers urged that either the leasing clause should be deleted or that the promoters should accept the condition that a lease, if granted, should terminate in 1931, the year when the powers of the existing companies may be bought up.

Mr. Bonar Law hoped the House would pass the Bill, in order that the need of the small manufacturer for cheap electricity should not continue unsatisfied for an indefinite time. He was himself in favour of private enterprise, because he believed that business matters were managed best by men who knew they would have to pay for failure out of their own pockets. At a County Council election the candidates were not chosen for their business qualities. The L.C.C. would be bound to have recourse to private enterprise.

Mr. Lloyd George, who was of opinion that the Bill should be read a second time and go to a committee, laid stress on the fact that the Hydrid Committee, which considered this question last year, recommended that the powers sought for should be vested in the municipality of London, and that it should have the right to conduct the enterprise itself or to lease it wholly or in part. This Bill, framed by a Progressive Council and now promoted by a Moderate Council, did not depart from the lines laid down by the Committee. The terms and conditions upon which a lease might be granted, were matters to be threshed out upstairs. It was a good suggestion that the Council should reserve the right to reconsider its position in 1931, when many of the existing companies would be purchasable. Municipal electrical enterprise in London had been very successful from the point of view of the consumer. While the charges made by the boroughs were considerably lower than the charges of the companies, there was still a profit. Whether a local authority should lease its undertakings was a question which it ought to decide for itself; but Parliament might restrict the power by imposing a time limit.

The debate was adjourned.

London Electric Supply Bill.—Mr. Lloyd George has given notice after the second reading of the London Electric Supply Bill to move:—"That it be an instruction to the Committee to insert in the Bill (if they find the preamble proved) provisions limiting the purposes of the Bill to the purpose of enabling the Joint Committee to be formed under the Bill to enter into and carry into effect any agreement which may be made between the Joint Committee and the London County Council under any Act which may be passed during the present or any future Session of Parliament for conferring powers on the London County Council with respect to the supply of electric energy."

Midland Railway Bill.—On May 9th Lord Ludlow's Select Committee of the House of Lords, considering the above Bill, refused to entertain the petition of the Yorkshire Tramways Co., who opposed the granting of the extension of time asked for by the Midland Railway Co., in respect of the line to Bradford sanctioned by their Act of 1898.

Birmingham Corporation Bill.—This Bill came on Thursday, May 9th, before the Unopposed Bill Committee of the House of Commons, presided over by Mr. Emmott. Mr. Pritchard (Parliamentary agent) explained that the House of Lords Committee had rejected the powers in the Bill for tramways to Harborne, and the only matter relating to tramways was the Clause dealing with the allocation of the cost of certain street improvements. In 1905 the Corporation obtained powers to construct a number of tramways, and also street improvements, and under that Act the whole of the expense was charged to the tramways account. It was felt that this was not fair, as a number of the widenings were necessary quite apart from the tramways. The Committees of the Corporation concerned in the matter had agreed that £80,000 should be charged to the improvements account. The Committee found the preamble proved, and ordered the Bill to be reported to the House for third reading.

North-East London Railway Bill.—This Bill, providing for the extension of time for the acquisition of land, &c., was before the Unopposed Bill Committee of the House of Lords on Tuesday, and was committed for third reading.

London United Tramways Bill.—This Bill came before Mr. Emmott's Committee on Unopposed Bills on Tuesday. Mr. Cripps (Parliamentary agent) said the Bill was now simply limited to an extension of time for the construction of certain tramways and the acquisition of land required for street widening purposes. Sir J. Clifton Robinson gave formal evidence, and said the extension was for two years only. The Committee ordered the Bill to go for third reading.

Great Northern and City Railway Bill.—In the House of Commons last week, Mr. Morton once more voiced the opposition of the City Corporation to the Bill, and on 9th inst. it passed its third reading.

Electric Lighting Provisional Orders (No. 1).—On Tuesday the Examiner found that Standing Orders were complied with in the case of Electric Lighting Provisional Order (No. 1) promoted to confirm provisional orders in respect of the following districts:—*Aston Manor* (Extension to Erdington), granted to the Corporation of Aston Manor. Power is given to the Erdington Council to purchase in 21 years instead of 42 as provided in the Electric Lighting Act, 1888. *Chesham*—Granted to the Urban District Council, amending the Order of 1901. *Hipperholme*—Granted to the U.D.C. amending the Order of 1905. *Lytham*—Order granted to the U.D.C. of Lytham in the county of Lancaster. Special power is given to transfer the Order within 12 months to the Lytham Electric Light and Power Co., whose registered offices are 66, Victoria Street, Westminster, S.W. *Newark*—Order granted to the Corporation for the amendment of their Order of 1900. Power is given to transfer to a company within 12 months. *Penrith*—Granted to the U.D.C. for the amendment of their Order of 1900. Power is given to transfer to the Penrith Electric Supply Co., Ltd., and Clause 4 states that nothing in the Order shall prevent the undertakers entering into contracts or arrangements with the Cumberland Electricity and Power Gas Co. *Pontefract*—Granted to the Corporation with power to transfer to the Electrical Distribution of Yorkshire, Ltd. *Stockport*—Order granted to the Corporation.

King's Norton U.D.C. Bill.—Mr. Corrie Grant's Committee has fixed the period for the repayment of the loan required for the purchase of the Bristol Road Tramways, and the reconstruction, adapting and equipping of the same, at 30 years from the date of borrowing.

Cavehill and Whitewell Tramways Bill.—The Select Committee of the House of Lords, appointed to consider this Bill, has reported that the promoters do not intend to proceed further with it.

Administrative County of London Electric Power Bill.—The order for the second reading of this Bill has been discharged as the Bill has been withdrawn.

Central London Railway Bill.—This Bill passed second reading in the Commons last week, after Mr. Morton, speaking on behalf of the Corporation, had moved its rejection.

ELECTRICITY SUPPLY IN COPENHAGEN.

The supply of electricity in Copenhagen is in the hands of the Municipality, and is carried out on the direct-current three-wire system, at 220 volts for lighting and 550 volts for traction. There are three electricity works—Gothersgade, Vestre, and Ostre Elektricitetsvaerk. The first-named was erected in 1890-2, and extended in 1904; it contains three Steinmuller, six Babcock & Wilcox, and five Stirling boilers, and three more Stirling boilers are being installed. Worthington and Weir feed pumps are used, and there is an economiser. The generating plant includes five steam dynamos of 200 to 800 kw., and two of 1,200 kw., while two more of the latter size are about to be installed. All the engines are of the vertical type, mostly triple-expansion and condensing, and were made by Messrs. Burmeister & Wain, of Copenhagen; the dynamos were supplied by Messrs. Siemens & Halske, and Messrs. Siemens-Schuckert. There is also a Tudor storage battery of 1,000-kw. capacity for three hours. The Vestre station started in 1898, and contains three Babcock and two Tischbein boilers, with five small Burmeister-Wain steam dynamos, and two batteries of 450 and 350 kw. respectively.

The Ostre station began work in 1902, and is equipped with six Borsig boilers, with superheaters and underfeed stokers, Weir feed pumps, and two economisers. In the engine-room there are four triple-expansion vertical engines of 1,000 i.h.p. each, coupled to 600 kw. Schuckert dynamos, with Edwards air-pumps, and two Tudor batteries of 460 and 450 kw. output. Most of the feeder and distributor cables are lead-sheathed and steel armoured, but part are of the Callender bitumen type. At the beginning of this year the total connections amounted to 19,000 kw., with about 200 motor cars on the tramways. The aggregate capacity of the generating plant is about 9,300 kw. For these particulars we are indebted to the chief engineer and manager, Mr. C. Hentzen.

The municipality recently invited tenders in this country, by public advertisement, for two 3,000-kw. steam turbines, complete with electrical generators and surface condensers. Offers were received from the leading manufacturers in this country, the Continent, and America, and some of the prices quoted were as follows:—

Brown, Boveri & Co., Baden...	... 362,000 kr. (£20,300)
Richardsons, Westgarth ...	... 380,000 kr. (£21,400)
British Westinghouse Co. ...	... 416,000 kr. (£23,400)
Burmeister & Wain	... 426,000 kr. (£24,000)
Willans & Robinson, Ltd. ...	... 437,000 kr. (£24,600)
Mather & Platt, Ltd. ...	... 443,000 kr. (£24,900)
Siemens (Berlin)	... 508,000 kr. (£28,600)
Allgemeine Electricitäts Gesellschaft	590,000 kr. (£33,200)

After carefully examining the merits of the various tenders and the constructive details of the turbines offered, the improved type included in Messrs. Willans & Robinson's tender received support at the hands of the technical adviser and of the manager of the electricity undertaking; but after prolonged discussion on the part of the municipal authorities, it was decided to entrust the work to the local firm of engineers, Messrs. Burmeister and Wain, in spite of the fact that their experience in the building

of turbines had been limited to the construction of one or two turbines of the smaller sizes. It is perhaps somewhat surprising that, after inviting tenders and issuing specifications in three different languages, thereby inviting outside manufacturers to compete, and to send in their proposals, so strong a preference should have been shown in favour of a local manufacturer, and it is to be hoped that the above action will not tend to discourage British manufacturers from competing in future for further contracts in Denmark for this class of machinery.

LEGAL.

CLEMENTS *v.* WARWICK.

MR. JUSTICE RIDLEY, sitting with a common jury in the King's Bench Division on Thursday, May 9th, had before him an action in which Herbert Clements claimed £143 from Thomas Warwick, who was stated to be a director of the New Motor and General Rubber Works, for work done and goods supplied. The defendant admitted part of the claim, but as to the rest pleaded that the plaintiff was incompetent to do the work, and the materials supplied were useless for the purpose.

Mr. GRIMWOOD MEARS, for the plaintiff, said the issue of fact was whether at certain interviews the plaintiff advised the defendant to have two electric motors of 10 and 15 H.P. respectively, or whether the defendant simply ordered them, without asking the plaintiff's advice. The amount claimed was the balance of account for fixing and supplying the motors, and for electric lighting work.

Plaintiff's case was that the defendant asked him for a quotation for some electric cables, and asked if he could find him a second-hand 15-H.P. motor. He did not say then what he wanted the motor for, but it transpired that he had some public entertainment grounds at Cleethorpes, and one of the attractions was a revolving platform half-way up a tower, on which about 150 people stood, and were taken round about twice a minute. He afterwards told plaintiff that he had worked it with a little 3-H.P. electric motor, but the people in Cleethorpes were getting a little tired of revolving towers, and he wanted to turn it into a flying machine, and he proposed to have boats revolved by some mechanism inside, and swung outside from the tower.

Mr. MEARS said he wanted a 10-H.P. to drive a water-wheel for "the Fairy River," but when he told plaintiff that his dynamo, from which he got the current to drive the motors, was 20 H.P., plaintiff told him he would never get 15 and 10 H.P. out of the motors. Defendant, however, said he should not want 10 H.P. for the Fairy River, and under these circumstances, Clements obtained the motors.

The PLAINTIFF gave evidence, and in cross-examination, said he had never seen a revolving round tower before.

After hearing further evidence, the JUDGE said it was not a case for a jury, and referred it to a referee.

RICHARD HORNSBY & SONS, LTD., *v.* BABCOCK & WILCOX, LTD.

IN the Chancery Division of the High Court of Justice, on Wednesday, May 8th, the trial of this action came before Mr. Justice Neville, and was continued on subsequent days. The plaintiffs claimed specific performance of an agreement of May 25th, 1906, for the sale of their water-tube business and certain plant, to the defendants. The defendants denied there was any agreement, and set up, in the alternative, that if there was, it was induced by misrepresentation, and by way of counterclaim asked for rescission of the agreement. The plaintiff company was incorporated in 1879, primarily to acquire the business of general engineers at Grantham. As there was a decline in the agricultural industry, they turned their attention to the manufacture of gas and oil engines. Their case was that they acquired, or invented, a form of boiler—known as the water-tube boiler—of a vertical nature which did not require much floor space. This business began in 1893, and rapidly developed. The defendants, Babcock & Wilcox, Ltd., are a company registered in England, and are an off-shoot of a very much larger company carrying on business in the United States. They had also embarked largely in the water-tube business, and they contemplated (it was suggested) becoming monopolists in this business, and buying up that portion of plaintiffs' business. The document on which plaintiffs sued, and which they alleged constituted the agreement, and asked the court to enforce was: "It is agreed between plaintiffs and defendants that (1) Hornsby's will sell, and Babcock & Wilcox will buy, the complete water-tube business of Hornsby's, including patents, drawings, existing agreements for licence, certain plant, patterns, and stocks and goodwill; (2) the price shall be—subject to adjustment of quantities and values of stocks, and to Hornsbys giving proof to Babcock & Wilcox of the figures relating to plant and tools—£30,680." Other heads of the agreement were that Hornsbys were to be allowed to execute existing orders, and should hand over to Babcock & Wilcox all drawings of their water-tube boilers, and agree to assign licences, &c. Babcock & Wilcox agreed to take over the Hornsby water-tube boiler business, Hornsbys agreeing to drop that business entirely. Both parties acted on this document being signed, and plaintiffs entirely dropped and gave up their water-tube boiler business and transferred every order to the defendants. The whole action of the parties was utterly inconsistent with its being other than a concluded agreement. The defendants' suggestion was that there was no definite agreement come to, and that the agreement had been induced by certain representations for which plaintiffs were responsible, which were not true. The plaintiffs' first answer was that these representations were not made by their agents. The defendants said that there were onerous covenants of which they did not know, and many questions of law and construction arose, but the main question of fact was whether Mr. Simpson was the agent of the plaintiffs and what materials defendants had before them when they entered, as plaintiffs said, into the agreement.

Mr. Eve, K.C., Mr. Jenkins, K.C., and Mr. Balfour Macnaghten appeared for the plaintiffs; and Mr. Petersen, K.C., and Mr. Manning for the defendants.

The hearing was adjourned until June 4th.

BUSINESS NOTES.

Electric Signs.—The Chinnery patent signs, which are adaptable for either electric or gas lighting, and are also at the same time effective for ordinary daylight service, were on show for several days last week at the Chemists' Exhibition held at Westminster. We understand that the development which has recently been made in the use of electric signs for advertisement purposes has brought the makers of the Chinnery devices a great deal of business. This we can quite understand, for on the occasion of our visit to the Exhibition referred to, the various signs shown were exciting a great deal of interest. The Chinnery sign devices have been on the market for some six years, as many electricity authorities are aware. One of the special lines is the patent prismatic sign, in which a band of coloured glasses passes over and beneath prismatic mirrors, causing the colours to reflect upon mirrors and rendering a very pleasing effect after the style of falling coloured waters. The reflectors are said to be equal to about 100 separate silvered glass mirrors to the superficial foot. For electrical signs ordinary incandescent glow lamps are employed. Another very serviceable example is the "Duplex," or "Two Signs in One." There is also the "Toplite" sign, which is claimed to give a good announcement of shopkeepers' goods by day and night. A patent perforated reflector at the back of the sign throws light upon the goods, while top reflectors, which are hinged, may be adjusted to concentrate extra light upon particular items in the windows. The multi-coloured sign, in which one small lamp suffices to effectively illuminate a large superficial area, is claimed to be very economical indeed in regard to current consumption. It is not possible in our pages to give anything like a true idea of the very effective display which can be made with these signs. Electricity supply engineers who are pushing this class of consuming device, and those interested in the sale of such things, should communicate with the CHINNERY ADVERTISING SIGNS, LTD., of 38, Eagle Street, Red Lion Street, Holborn.

Holidays.—With the first few hours of warm sunshine to remind us of summer, and the first batch or two of trade lists of electric fans wherewith to keep in the perspiration, there also comes a reminder that the holidays are near at hand. This takes the form of a number of health-resort booklets published by the Health Resorts Development Association, of 29, John Street, Bedford Row, W.C. These relate to Bournemouth, Tenby and Weymouth, and a postcard request to the town clerk of any of these places will bring back a copy of the desired booklet.

Book Notices.—*Journal of the British Fire Prevention Committee*, No. IV, February, 1907. Record of the Special Commission appointed to visit the principal cities of Italy on the occasion of the International Fire Service Congress at Milan, 1906. London: The Committee. Price 5s.—This is an exceedingly interesting number of the *Journal*, being profusely illustrated with excellent photographs of Milan Exhibition, numerous fire brigades with their equipment, displays of drill, ancient Roman watch stations, the use of "Roman" ladders, reinforced concrete construction, and other interesting features. Amongst the latter we notice the equipment of the private fire brigade of Messrs. Pirelli's electric cable and general india-rubber works, Milan, and the "modern risks" apparatus of the Technical Co., which includes special tool-chests for tramway, telephone and electricity supply works. Particulars of the various brigades, &c., are given in the letterpress, and the whole forms a very useful souvenir of the Congress.

"Railway Rates, and How to Check Them." By J. H. Fitton. Huddersfield: The Author, 67, Norman Road, Birkby. 1907. 3s. net.

"La Télégraphie sans Fil et la Télémécanique. By E. Monier. Paris: H. Dunod & E. Pinat. 1907. Price 2 fr.

Bankruptcy Proceedings. — E. CROMPTON HOLT (Holt & Co.), electrical engineer, Rhyl.—The *London Gazette* for May 14th contains particulars of a composition scheme which has been sanctioned by the Bangor Court. The receiving order is discharged, and the order of adjudication is annulled.

ARTHUR BLACKBURN, electrical and mechanical engineer (Blackburn, Walker & Co.), Cleckheaton.—The *London Gazette* for May 14th contains notice of the conditions upon which bankruptcy is to be discharged.

Catalogues and Lists.—Small Power Dynamo and Motor Co., Old Lane, Openshaw, Manchester.—New list (4 pp.), giving illustrations, brief specification and prices of small direct current motors and semi-enclosed dynamos, also motor-starting rheostats.

The Telegraph Condenser Co., 4, Great Winchester Street, E.C., and Peckham.—16-pp. finely illustrated catalogue of various types of standard condensers for submarine cables, artificial cable boxes, and artificial lines for duplex working, artificial cables for experimental use in colleges and schools. Prices are given. There also appear a temperature coefficient table for the correction of the tests of condensers and artificial cable boxes, and curves showing the variation of loss of charge and the dielectric resistance in microfarads between the temperatures of 32° and 88° F.

Ozonair, Ltd., 27, Chancery Lane, W.C.—Very finely prepared catalogue (40 pages) telling "All About Ozonair." It contains full description, together with lists of prices of this ozonising apparatus, of which we have given a good deal of information at different times. The illustrations show important buildings where Ozonair apparatus is being used, also a view of the company's electrical and chemical laboratory in Chancery Lane, a photograph showing the application of the system in a brewery, and other illustrations of small portable generators and small fixed patterns, the open and closed grid generators, the Ozonair filter, fans and air-washing screens for use with the apparatus, transformers, converters, &c. Some notes are given relating to the various commercial applications to which the Ozonair apparatus has been or can be put.

Messrs. Krupka & Jacoby, 61/62, Watling Street, London, E.C. —Catalogue containing in 54 pages full particulars, illustrations and prices of their electro-medical apparatus. These include portable batteries, transformers, surgical lamps, induction coils for faradisation, apparatus for sinusoidal faradisation, galvanisation, electrolysis and cataphoresis; also small electric motors, electric light baths, hydro-electric baths, high-frequency apparatus, &c. Reference numbers, brief descriptions and prices are conveniently arranged in tabular form.

The Allgemeine Elektricitats Gesellschaft, Foreign Department, Caxton House, S.W., have sent us a pamphlet by Otto Nairz on "Undamped Oscillations in Wireless Telegraphy," in which the general principles of the art are explained. While due credit is paid to Poulsen as the first to obtain high-frequency undamped waves, with the aid of hydrogen gas to cool the arc, it is stated that the Ges. für drahtlose Télégraphie (Telefunken system) has succeeded in obtaining equally good results without hydrogen, using as anode a copper vessel cooled with water, and connecting a number of arcs in series-parallel.

Messrs. Johnson & Phillips, Ltd., Charlton.—Pamphlet (4 pages) containing an illustrated description of the Collins testing brake, of which they have the sole rights of manufacture.

Messrs. J. C. Lyell & Co., Ltd., 55, Victoria Street, Westminster, S.W.—Pamphlets describing their new electric hand-drilling machines (Langbein's system) with three speeds for drilling holes up to 16 mm. in iron or steel. Also a second publication giving a fully illustrated description with prices of the "Verdol" accumulators.

Messrs. Applebys, Ltd., 56, Victoria Street, S.W.—Section A catalogue (100 odd pages) describing their various steam and electric jib cranes of many types and sizes. Short descriptions are given, together with large numbers of good half-tone views of portable steam, electric jib, and steam and electric gantry, derrick, forge and foundry cranes, as well as electric single rail cranes, fixed electric, floating steam and other cranes. Some brief notes are given concerning the advantages of electric cranes, cost of current for electric quay cranes handling cargo and ore, or working with grab bucket, &c.

The British Electric Plant Co., Ltd., Alloa.—24 page illustrated catalogue just issued dealing with the B.E.P. standard four-pole motors and dynamos. A view of the company's works is followed by general information and a full specification, enlivened by neat half-tone illustrations. Tables of prices and particulars of open protected and protected types of motors, also of crane-rated motors appear, and the other contents of the pamphlet relate to variable speed compensated motors with patent interpoles, and B.E.P. standard dynamos. The company claim that all their standard four-pole machines are fitted with compensated poles, by means of which they can ensure sparkless running and very large speed variations.

Messrs. Veritys, Ltd., Manchester.—Two catalogues descriptive of the Peard patent fuses. No. 522 shows the "Switchboard" type. We understand that the fuses are now being made in a manner which takes all strain off the plaster holder. The contacts are built up on a skeleton frame, the foundation of which is vulcanite. The frame is then put in a mould, and plaster formed round it, so that the contacts do not owe anything for their support to the plaster, as was the case in the original design; and, in the event of the plaster breaking, it is not a difficult matter to replace it without interference with the general construction. The other catalogue, No. 555, contains particulars of the Peard non-explodable steel-cased "Tubular" fuse for protecting underground network circuits, for mines, theatres, switchboards, and so on.

Messrs. D. Santoni & Co. (1906), Ltd., 15-17, Beauchamp Street, Holborn.—Two new pamphlets, Z and Z1, describing their portable accumulators for carriage lighting, ignition, &c., and their portable electric safety lamp; also leaflet M1, giving illustrated particulars of their electric fans. All of the lists are fully priced.

Indicating Wattmeters.—Messrs. Everett, Edgcumbe & Co., Ltd., of 87, Victoria Street, Westminster, have sent us particulars of their indicating wattmeters for use on A.C. and D.C. circuits. The instruments are of the dynamometer type, and special precautions have been adopted in order to eliminate errors due to self-induction, capacity and eddy currents, &c. They are made in two forms—viz., the "Standard" and the "Industrial" types. The latter is suitable for all ordinary conditions met with in practice, and a curve is given, the result of tests made at the National Physical Laboratory, showing that the error due to variations in power-factor down to 0·25 does not exceed 1 per cent. In the Standard type very high accuracy can be obtained when used on all power-factors down to about 0·1. These indicating wattmeters are made in four patterns—round, edgewise, sector and portable. Each of these patterns, again, is made in various models for use on single or polyphase circuits, balanced or unbalanced loads, there being in all 10 different models. The Standard Portable pattern will be found useful for general all-round testing or as a laboratory standard; it can be used in either the vertical or the horizontal position, and is provided with the usual anti-parallax device. Astatic indicating wattmeters are recommended where very intense stray fields are likely to be met with.

Trade Statistics of Brazil.—The following statistics of the imports of electrical and other materials into Brazil are taken from the recently issued trade statistics of that country for 1905; the figures for 1904 are added for purposes of comparison:—

	1904. Milreis*	1905. Milreis
Copper wire, ordinary, or covered with paper, cotton, silk, gutta-percha, &c.		
From Germany	384,237	326,690
„ France	40,864	36,092
„ United Kingdom	329,029	146,698
„ United States	285,945	356,558
„ Other countries	13,547	23,915
Total	1,053,422	889,953
Manufactures of copper not separately mentioned (not including tubes)—		
From Germany	1,023,129	1,034,126
„ France	697,034	600,379
„ United Kingdom	1,037,703	817,725
„ United States	192,680	171,910
„ Other countries	335,673	262,795
Total	3,286,219	2,886,935
Electric lighting, &c., apparatus and accessories—		
From Germany	788,789	902,292
„ France	189,636	258,083
„ United Kingdom	741,666	741,429
„ United States	1,252,655	1,798,529
„ Italy	14,352	13,964
„ Belgium	14,575	7,019
„ Switzerland	20,261	24,155
„ Norway and Sweden	19,529	21,285
„ Other countries	210,412	196,102
Total	3,051,875	3,772,858
Hydraulic pumps—		
From Germany	73,866	43,643
„ France	19,261	26,532
„ United Kingdom	213,594	113,707
„ United States	145,660	94,724
„ Other countries	4,684	9,906
Total	457,065	288,512
Boilers and similar appliances—		
From Germany	144,363	115,969
„ France	23,166	67,254
„ United Kingdom	529,494	614,690
„ United States	147,440	193,670
„ Other countries	50,051	44,305
Total	894,514	1,035,888
Rails and accessories—		
From Germany	1,179,941	496,770
„ France	108,696	232,852
„ United Kingdom	1,388,374	2,111,603
„ United States	135,849	413,935
„ Belgium	4,100,616	5,100,383
„ Other countries	—	124
Total	6,913,476	8,355,667
Insulators—		
From Germany	41,881	31,106
„ France	3,939	5,591
„ United Kingdom	17,021	6,856
„ United States	15,325	25,830
„ Other countries	4,128	2,402
Total	82,294	71,785

* Milreis=1s. 3d.

Small Motors.—According to a Consular report, there is a great demand in Corfu for motors from 2 to 6 H.P. for wood-cutting purposes.

Conduit Enamels.—Some considerable attention has of late been devoted to the production of enamels for conduit tubes. We have now received a sample of such tubing from the Metallic Seamless Tube Co., Ltd., of Wiggin Street, Birmingham. It is a specimen which had been in no sense specially prepared, but which, we understand, fairly represents their ordinary stock close-tube jointing, and is a sample of what they are continually supplying to the trade. The result seems to be very satisfactory, several sharp bends having had no material effect on the enamel.

Liquidations.—The Electro-Medical Supply Co., Ltd.—A meeting is to be held at 70a, Basinghall Street, E.C., on June 17th, to hear an account of the winding-up from Mr. H. Crewdson Howard, liquidator.

McPhail & Simpson's Dry Steam Patents Co., Ltd., Calder Works, Wakefield.—May 28th is the last day for sending proofs for intended dividend to Mr. J. W. Close, the liquidator, at North British and Mercantile Buildings, East Parade, Leeds.

R. W. Vicarey, Ltd.—This company is winding up voluntarily, with Mr. F. J. Harper, County Chambers, High Street, Shrewsbury, as liquidator, as it cannot, by reason of its liabilities, continue business.

Land and Water Electric Power Syndicate, Ltd.—A meeting is to be held at Bradford on June 18th to hear an account of the winding up from the liquidators, Messrs. J. B. Childe and S. B. Saunders.

Trade Announcements.—With reference to the description in our issue of May 3rd, of Messrs. Morris & Lister's new knife switches and fuses, we are asked to state that further particulars and samples of these can be seen at the offices of their sole selling representatives, Messrs. Frampton & Paine, 29, Old Queen Street, Westminster, S.W.

Messrs. Hubert Davies & Spain, engineers and shippers, of Salisbury House, E.C., announce that the title of the firm has been changed to Hubert Davies & Co.

The Kevan Electric Co., Ltd, have commenced business at 88, Charing Cross Road, London, W.C., dealing chiefly with lighting material of every description. The show window has been specially constructed and designed to attract attention, and to demonstrate the advantage which can be obtained by using the firm's patent silvered glass reflectors, which are claimed to show a large saving in current consumption. The company will supply incandescent electric lamps, flex and cable of English manufacture, also Schiff carbons and carbon brushes, and other electrical material.

Mr. Lister is no longer connected with Messrs. H. G. Mayer, of 107, Aldersgate Street, but is now acting as joint manager for the Kevan Electric Co., Ltd., mentioned above.

Messrs E. P. Allam & Co. have appointed Messrs. J. Parkinson and Co., of Post Office Chambers, St. Nicholas Street, Newcastle-on-Tyne, as their sole selling agents in the Northumberland and Durham districts. Messrs. Allam have recently placed on the market several novelties in connection with their Premier motor starting appliances. Among these may be mentioned heavy duty starters with magnetic blow-outs, gas and water-tight starters, universal starter panels with and without instruments.

Mr. John I. Hall, of 1, Durlston Road, Kingston-on-Thames, is the agent for London and the southern counties, also selling agent for the Colonies, for the Wilkinson live-steam feed-water heater. We understand that a considerable number of heaters have lately been ordered for land and marine boilers, and repeat orders have also been obtained. A small illustrated pamphlet on the subject has recently been issued.

Messrs. D. Santoni & Co. (1906), Ltd., have now taken over the sole selling agency for Lowden incandescent lamps, manufactured by the Lowden Electric Lamp Co., Ltd., of Acton Green, W. Copies of leaflet A1 relating to these lamps will be sent on application. The lamps are of English manufacture.

Condensing Plant.—The Mirrlees Watson Co., Ltd., of Glasgow, have just received orders for condensing plant for the following works:—

Surface Condensing Plant.

J. and P. Coats, Ltd., Paisley.—Three sets, duty each 24,000 lb. steam per hour.

Powell-Duffryn Steam Coal Co., Ltd. (per Messrs. James Howden & Co.) duty, 38,000 lb. steam per hour.

City of Hereford Electricity Station.—Duty, 7,500 lb. steam per hour.

Ateliers Thomson-Houston New Turbine Works, Lille.—One set, duty 22,000 lb. steam per hour.

Sunderland Shipbuilding Co., Ltd.—Auxiliary condensing plant and condenser for Messrs. Gwynnes, Ltd.

Barometric Jet Condensing Plant.

W. Beardmore & Co., Ltd. (per Mr. P. J. Mitchell).—One set, duty 86,000 lb. steam per hour.

Stewart & Lloyd, Ltd. (per Mr. P. J. Mitchell).—One set, duty 86,000 lb. steam per hour.

Elevated Self-Draining Jet Condensing Plant.

Taylor Bros. & Co., Ltd.—One set, duty 90,000 lb. steam per hour.

Trade Statistics of Spain.—The trade volume of Spain for 1905, recently issued, gives certain interesting details as to the importation of electrical materials. The imports of copper, brass and bronze wire amounted in value to 3,082,670 pes. in 1905, as compared with 3,139,430 pes. in 1904; the imports from Germany increased from 1,457,370 pes. to 1,612,630 pes., whilst those from France and the United Kingdom decreased from 1,516,908 pes. to 1,259,540 pes., and from 63,180 pes. to 51,760 pes. respectively. The imports of incandescent electric lamps were valued at 489,587 pes. in 1905 (Germany 273,138, France 134,947, Great Britain 3,300, and Holland 27,517), as compared with 611,756 pes. in 1904 (Germany 345,276, France 97,165, Great Britain 234, and Holland 74,081). The imports of arc lamps, electric meters, commutators, &c., decreased in value from 1,793,472 pes. in 1904 to 1,572,352 pes. in 1905 (Germany 1904, 1,159,856 pes.; 1905, 987,352 pes.; Belgium 1904, 21,672 pes.; 1905, 52,352 pes.; United States 1904, 21,856 pes.; 1905, 28,232 pes.; France 1904, 464,720 pes.; 1905, 434,200 pes.; Great Britain 1904, 14,520 pes.; 1905, 17,720 pes.; Switzerland 1904, 64,344 pes.; 1905, 31,120 pes.). The imports of telephone apparatus were valued at 158,851 pes. in 1905, as compared with 177,156 pes. in 1904; the imports from Germany decreased from 74,823 pes. to 51,198 pes.; Belgian imports increased from 11,690 pes. to 23,389 pes.; French from 48,783 pes. to 56,000 pes., Swedish from 6,895 pes. to 16,646 pes. and British from 35 pes. to 1,491 pes. The imports of motor machinery, with or without boilers, were valued at 11,804,797 pes. in 1905 (Germany 4,675,927 pes., Belgium 957,653 pes, France 1,519,461 pes., United Kingdom 3,261,451 pes., Switzerland 646,979 pes., and the United States 329,092 pes.), as against 13,421,159 pes in 1904 (Germany 5,419,512 pes., Belgium 824,034 pes., France 1,718,412 pes., United Kingdom 3,932,889 pes., Switzerland 638,781 pes., and the United States 152,387 pes. The imports of locomotives and locomobiles were valued at 1,638,877 pes. in 1905, as against 2,506,309 pes. in 1904 (Germany, 1904, 1,285,923 pes., 1905, 443,736 pes.; United Kingdom, 1904, 592,910 pes., 1905, 1,010,704 pes.)

The imports of machinery of copper were valued at 821,012 pes. in 1905 (Germany 317,712 pes., France 304 084 pes., Great Britain 139,108 pes.) as against 1,293,356 pes. in 1904 (Germany 516,472 pes., France 629,556 pes., Great Britain 75,880 pes.) The imports of other machinery not including agricultural, sewing, &c., were valued at 33,767,606 pes. in 1905, as against 38,831,722 pes. in 1904; the chief suppliers in 1905 were Germany 10,222,867 pes. (decrease of nearly 6 million pes), United Kingdom 9,741,352 pes. (slight increase), France 8,087,032 pes. (increase of nearly 1½ millions), Belgium 2,395,715 pes. (decrease of 1,000,000 pes.). The imports of cables for conducting electricity were valued at 1,778,980 pes. in 1905, as compared with 1,372,854 pes. in 1904 (Germany, 1904, 1,011,177 pes.; 1905, 1,422,910 pes.; Italy, 1904, 199,537 pes.; 1905, 154,445 pes.; United Kingdom, 1904, 37,895 pes.; 1905, 115,382 pes.).

The imports of electrical materials free of duty for Government and other purposes, were as follows in 1905:—Copper, brass and bronze wire, 1,018 pes.; electric incandescent lamps. 1,500 pes.; arc lamps, &c., 18,600 pes. (Germany 17,176 pes., France 1,424 pes.); telephone apparatus, 917 pes.; motor machinery, &c., 357,550 pes. (Germany 207,047 pes., France 38,938 pes., Great Britain, 109,690 pes.); cables for conducting electricity, 74,477 pes. (Germany 60,914 pes., France 13,563 pes.). N.B.—Peseta = $9\frac{6}{10}$d., or 25 pes. = £1.

LIGHTING and POWER NOTES.

Barnsley.—During the past year the electricity department has made a net profit, including a balance of £1,590 brought forward, of £3,311. It is proposed to grant £500 again in relief of the rates and to reduce the charges to consumers.

Beckenham.—The U.D.C. has appointed a sub-committee, consisting of the Chairman of the Council and the Chairman of the Electricity Committee, to negotiate with the South Metropolitan Electric Light and Power Co. for a supply of electricity in bulk, the company having made an offer. A proposal that the matter should be put aside until there was a report as to the result of the working of the Council's undertaking, with full particulars and figures, did not find support.

Continental Notes.—St. Petersburg.—From the annual report of the Société d'Eclairage Electrique de Saint Petersburg, we learn that, during the past year a considerable extension of the plant was made, the additions comprising a 2,500-H.P. steam turbine and alternator, two boilers with superheaters, a continuous-current transformer set, and a battery of accumulators. The mains now extend to a total length of 385 km., including 77 km. for public lighting purposes. The number of transformers in use increased from 1,174 at the end of 1905 to 1,213, their capacity being 12,544 KW., giving an average of 10·3 KW. The number of consumers supplied by the company is now 11,260—an increase of 1,164 for the year, while the number of lamps connected is equal to 383,765 of 10 C.P., as against 354,404. In addition, the public lighting is equal to 7,318 10-C.P. lamps. The total receipts for 1906 amounted to £197,319, as against £169,522 in 1905 and £162,871 in 1904. The output of electricity is returned at 16,652,012 KW.-hours at a gross cost of £81,737, the profit for the year working out at some £116,000, which compares with £94,000 in the preceding 12 months.

Vienna.—An agreement having been come to with the Vienna Electricity Society, the city authorities took over the former's system as from 1st inst., the stipulated price being 5,300,000 kronen. It is stated that the municipalisation of the system will involve no increase of price to the consumer.

Budapesth.—Negotiations between the municipality and the Budapester Strassenbahn Aktiengesellschaft and the Budapesther Elektrische Stadtbahn Aktiengesellschaft, with a view to exercising the right of the first-named to acquire the systems of the two companies in 1910, have not ended satisfactorily, owing to the onerous terms asked for, and the companies have been asked whether better terms cannot be offered. Failing these, the town engineer has

been instructed to draft plans for the establishment of a municipal system, which will be run in competition with the two companies.

FRANCE.—It is announced that La Societé des Houilleres de Ronchamps is putting down a 7,000-H.P. plant, comprising three steam turbines, each coupled to a 1,500-KW. alternator. The current will be generated at 5,000 volts pressure, and afterwards transformed to 30,000 volts, to enable it to be transmitted within a radius of 50 miles. Among the towns to be supplied both for public and private lighting purposes are Belfort, Luxcuil, Lure, Remcremont and Hericourt.

ITALY.—The Common Councils of Chiusi and Tarteano have entered into contracts for a generating station with gas-driven sets for the illumination of the two cities; later on a transmission scheme is also to be put to work from Santa Fiora, when the gas station will be utilised as a reserve.

The electrical company of Cianezzo is beginning to excavate another reservoir, in connection with the hydro-electric installation, at an altitude of 425 metres, with a total capacity of 10,000 cubic metres. It is intended, when there is a shortness of water, to pump back some of the water to the high level during the hours when the installation is lightly loaded.

BERLIN.—On Thursday evening last week a failure of the electric light in two of the main streets in the city, resulted in a repetition of the scenes witnessed in Paris recently, but on a smaller scale.

Croydon.—The L.G.B. has sanctioned loans for the electricity department, amounting in the aggregate to £21,812, the items being as follows:—£9,973 for mains, house service, and sub-stations, repayable in 20 years; £708 for transformers, repayable in 15 years; £1,504 for meters, repayable in 15 years; £9,627 for excess expenditure and new works, repayable in 15 years.

Darlington.—The T.C. has decided to oppose the Bill of the Cleveland and South Durham Electric Power Co., which company is seeking power to extend its area of supply to Darlington.

Dundee.—The T.C., on the recommendation of the electrical engineer, has decided to abolish the minimum charge for meters for lighting, in the case of all residential tenements. It has also been decided to include powers to supply on hire or sale, motors, lamps, and all electrical apparatus, in the forthcoming provisional order to be promoted before the B. of T.

The T.C. and the Harbour Trustees have at last come to an agreement as to the price to be paid for the site of the new power station.

The scheme of extension as prepared by Mr. Richardson and approved by Mr. Snell, involves an outlay of £55,000. In the new station it is proposed to install three large turbo-alternators to generate current at 6,000 volts pressure. This will be transmitted to sub-stations for conversion to a voltage of 450-500. Despite the pressing need, the new station can hardly be ready to meet the winter's demand.

Dunfermline.—The T.C. last week rejected an offer of the Fife Electric Power Co. to supply up to 100,000 units at 1½d. per unit, in favour of installing a suction gas-driven generating plant in the town.

East Ham.—The E.L. Committee has approved an estimate, submitted by the engineer, of £1,599, for the construction of two additional cooling towers with foundations complete, to be attached to the existing towers. Application is to be made to the L.G.B. for a loan.

Faversham.—The T.C. on May 8th discussed a motion to dispose of the E.L. undertaking "with a view to reducing the rates, in consequence of the unsatisfactory lighting and the existing heavy rates incurred thereby." An amendment deferring the matter until the autumn was carried by eight votes to four.

Frome.—A loan of £11,100 for electricity purposes, has been applied for by the U.D.C.

Formby.—The B. of T. has granted a prov. order for electric supply to the U.D.C.

Gainsborough.—In deferring the question of revoking the E.L. order for a year from June 24th, 1907, the B. of T. has informed the U.D.C. that, if at the end of that period it cannot furnish the Board with evidence that the order is being put into force, it would be revoked without further notice.

Grimsby.—The T.C. has applied for a loan of £4,000 for additional plant for the electricity works.

London.—L.C.C.—The Council at its meeting on Tuesday, resolved to sanction the borrowing of £10,000 by the Stepney B.C. for the extension of mains.

The Highways Committee reported having had under consideration the question of the fees to be charged by the Council for duties performed by its inspectors under the provisions of special Acts or provisional orders. The Committee recommends the Council to fix a charge of £10 a year for the first three testing stations or less in the same area of supply, and a charge of £2 per annum for each additional testing station in the same area.

STEPNEY.—Considerable discussion took place at the last meeting of the B.C. with respect to the electricity undertaking, the recommendations in regard to which were given in the last issue of this paper. In regard to the estimate of £54,000 in connection with the Blyth's Wharf scheme, of which £36,900 is to be spent to deal with the load at Christmas, 1908, the consideration of the estimate was adjourned, but the recommendation instructing the Committee to prepare for submission detailed plans was carried. The recommendation that Mr. Tapper be entrusted with the whole of the work in connection with the new generating station was referred back.

HAMMERSMITH.—A L.G.B. inquiry is at present being held into the excessive cost of the new workhouse and infirmary at Wormwood Scrubbs. In this connection some interesting evidence has been given as to the cost of the electrical plant, which amounted to £6,974, as against about £5,500 tendered. It was contended that 30 per cent. of the original tenders were extravagant expenditure, and that £1,300 had been expended in retrieving errors. The evidence showed that the total number of lamps installed amounts to some 4,000; that steam, gas and electricity were employed in the building, sometimes as alternatives; that D.C. lift motors had been employed, although the supply was an A.C. one; and that, in fact, the equipment was practically throughout on a luxurious scale. The inquiry was adjourned until May 29th.

Luton.—A L.G.B. inquiry was held on May 7th into the application of the T.C. for a loan of £17,000 for electricity purposes. There was no opposition.

New Zealand.—DUNEDIN. Mr. Watson Munro, of Messrs. A. & T. Burt, has been appointed by the City Council to advise as to the value, stability, efficiency and workmanship of the whole of the plant installed by Noyes Bros., in and from the power-house at Waipori to Half Way Bush, together with the electric equipment in connection therewith. The equipment includes all works carried out by Noyes Bros. within the city. Mr. E. H. Drew, of the same firm, has been appointed to report upon the hydraulic portion of the works.

Ravensthorpe.—The U.D.C. has received from the L.G.B. sanction for a loan of £2,425 for electricity purposes. The B. of T., replying to the Council's application for an extension of time for carrying out the E.L. order, has stated that if it is satisfied that by August 4th next, active steps are being taken to put the order into operation, it would be prepared to consider the question of deferring the revocation of the order.

The U.D.C. has consented to the Yorkshire Electric Power Co. supplying energy to works in the district.

Sunderland.—The T.C. has applied for a loan of £10,000 for E.L. purposes.

Walsall.—A L.G.B. inquiry was held on May 9th, into the application of the T.C. for a loan of £700 to defray the cost of erecting a new chimney at the generating station. There was no opposition.

Warwick.—The C.C. has entered into an agreement with the Leamington and Warwick Electrical Co. for the supply of electricity to the County Buildings at Warwick.

Wednesbury.—At a T.C. meeting held last week, Mr. T. Griffiths presented a statement showing the progress of the electricity undertaking. He explained that at the commencement of the undertaking in March, 1904, there were 1,180 lamp connections for lighting, and in March, 1907, that number had increased to 7,098; whilst the amount of electricity sold had increased from 38,881 units to 105,000 units. The total amount paid for electricity was £764. The Corporation had bought 173,700 units, so that a considerable quantity had been lost. He calculated that 20 per cent. of this represented losses in the batteries, and that 30 per cent. of the units bought, had been lost in conversion from alternating to direct-current. If the Corporation had generated its own electricity, the cost of producing the 100,000 units sold would have been £240, against £764 which had been paid to the power company.

West Ham.—The electrical engineer has reported that the load is increasing so rapidly on the 6,000-volt system, that by the time the second turbine is delivered, there will be more than it can do by itself. He had considered the advisability of having this generation made for 6,000 volts instead of 2,000, and saving further cost in step-up transformers, and he suggested that the contractors be notified accordingly. Mr. Seabrook further asked for permission to get tenders for an ash conveyor, as the expense of dealing with ashes by hand will shortly be considerable. The Anglo-Continental Guano Co. has decided to take a large supply of energy night and day on a five years' agreement. The Committee has agreed to a suggestion by the electrical engineer for the purpose of meeting applications for the supply of electricity to premises off the route of the existing mains, and which involve extensions of cable which would not be warranted by the income to be derived at the moment. In such cases the cost of the extensions could be overcome by laying a pipe, and for the time being using small rubber or bitumen covered wires to meet immediate requirements, and as the load increased to remove and replace them by permanent lead-covered cables.

Wigan.—The Electric Light and Tramways Committee held special meetings last week to consider the financial position of its undertaking. No report of the year's working has yet been published, but it has transpired that a serious loss has been incurred, not so much in the electricity as in the tramways department. The former, indeed, shows a profit of some £2,000, but for the 12 months ending March 31st the tramways, it is believed, will show a debit balance of over £15,000. How this loss will be met has not yet been decided.

Wolverhampton.—The Electric Lighting Committee of the Corporation has presented to the T.C., a report setting out the extensions that will be necessary at the Corporation Electricity Works, in order to meet the proposed supply of electricity to Messrs. Bayliss, Jones & Bayliss, Ltd., and also the ordinary growth of the

undertaking. The Council has already authorised an expenditure of £16,000 in order to provide the supply for Messrs. Bayliss. The electrical engineer reports that immediate provision must be made for the extension of the boiler-house buildings to accommodate the additional boilers and accessories, and it will also be necessary to provide for a new chimney. It is proposed that both boiler house and engine room shall be extended for a length approximately of 57 ft., which will provide sufficient room for the reception of four boilers and four generating sets of a total capacity of 4,000 KW., but it is only proposed at the present moment to install two boilers and two generating sets, the capacity of which will be 2,000 KW. Of this amount of power 1,000 KW. will be immediately required by Messrs. Bayliss, and practically the whole of the remainder will be taken by anticipated new consumers very shortly after it is ready for work. It is proposed to install in the boiler house two large water-tube boilers, having an evaporative capacity of 20,000 lb. of water per hour each. Economisers will be installed in the main flue, and a steel chimney provided 175 ft. in height. Each generating set will consist of a steam turbine direct-coupled to a three-phase alternating-current generator, and will be equipped with independent condensing plant. Electricity will be generated by these sets at a presure of 6,000 volts, and will be transmitted at this pressure to Messrs. Bayliss' works, where it will be transformed down for motive power and lighting purposes, and similarly in the case of other large consumers. The capital expenditure to be provided for will be for the generating station £30,000, for mains £15,000, a total of £45,000. With respect, however, to the proposed expenditure at the generating station, the Committee has unexpended capital to the extent of £10,000, upon which it is already paying interest and sinking fund, and consequently the amount of the loan to be applied for under this head will be £20,000. It is therefore proposed to apply for a loan of only £35,000.

Wishaw.—At a meeting of the T.C. on Monday, a letter was read from Mr. A. Slatter, consulting electrical engineer, London, proposing to purchase the burgh's electricity undertaking, and offering the capital sum expended on the scheme. It was stated that the loss on the current year's working was £548 12s., while the estimated deficiency next year was £459. After discussion, the offer was allowed to lie on the table.

TRAMWAY and RAILWAY NOTES.

Belfast.—A public meeting was recently held at Ligoniel, when a resolution was passed urging the desirability of extending the Corporation tramways through the village.

China.—SHANGHAI.—According to the *Standard*, the forthcoming opening of the tramway service next month is arousing considerable native opposition, on the grounds that some 10,000 jinrikisha coolies will be affected, and that the tramways are dangerous. The Chinese guilds are urged to boycott the tramways.

Chesterfield.—The second year's working of the Corporation tramways resulted in total receipts amounting to £11,492; working expenses amounted to £6,110, and financial charges £3,998, leaving a net balance of £1,322. Altogether 275,417 car-miles were run, and 2,302,097 passengers carried.

Continental Notes.—AUSTRIA.—The Ministry of Railways has approved of the plans for a projected normal gauge electric railway starting from Innsbruck and ending at Reutte. This represents the section on Austrian soil, and the line will be continued beyond the border.

The surveys for several other electric railways have been sanctioned, both in Austria and in Hungary.

Edinburgh.—The Tramways Committee has decided to obtain estimates for the construction of the Gilmore Place and Broughton routes on the cable system; an extension of the Tollcross power station will be required.

London.—The City and South London Railway extension to Euston was formally opened on Saturday last by Mr. H. Percy Harris, chairman of the L.C.C. The new section is some 1¼ miles in length.

The City Corporation has now instituted a complete service of electrically-driven ambulances, in connection with which 52 telephone call boxes in the streets provide communication with the police headquarters at Old Jewry.

L.C.C.—An agreement has been come to between the L.C.C. and the Lambeth B.C. with regard to the reconstruction of the London Southern Tramways System, and clauses have been agreed to providing for the widened portion of the roadway being vested in the B.C. and for the electrification being completed in two years from October, 1907. The Select Committee of the House of Commons has sanctioned this scheme, together with the proposed new tramways as follows:—Junction line in South Lambeth Road, junction line in Stockwell Road, loop line along Herne Hill Road and Wanless Road, and loop line along Poplar Walk and Lowden Road.

On Saturday last a further extension of electric tramways in North London—from Wood Green to New Southgate—was opened for traffic. Good progress is now being made with the Wood Green to Enfield extension, the first section of which (to Palmer's Green) will be opened shortly after Whitsuntide.

The Finance Committee, at a meeting of the L.C.C. on Tuesday, presented a report on the proposal of the Highways Committee to expend £23,150 on the manufacture of 50 tramcar bodies by the direct employment of labour at the Leytonstone depôt. It appeared that the estimated cost of each of the 50 bodies, which form part of 300 authorised last December, worked out at £463, as against £489 10s., which was the amount of the contract for the remaining 250 bodies, for which a tender was accepted in March. If, however, the contractor were entrusted with the additional 50 car bodies, he would be prepared to supply them at £479 10s. each. The net estimated saving to be effected by the employment of direct labour was therefore £825, although the Highways Committee, in recommending that step, had no desire to establish a precedent in favour of that policy. Apart from the calculated saving in cost, the Finance Committee was satisfied that there were good grounds for the proposal, and it was informed that no additional plant or machinery would have to be purchased in connection with the construction of the car bodies, whilst it would obviously be convenient to have the existing building, plant, &c., fully utilised.

Manchester—Altrincham.—On Thursday (9th) two new extensions of the Manchester electric tramcar system were inaugurated, namely, to Chorlton-cum-Hardy and to Altrincham. The Chorlton extension is 1 mile long, and on Wednesday evening an illuminated car travelled over the new route. The Altrincham extension makes a total length of lines from Manchester of 8 miles, and Alderman Wilson, chairman of the Permanent Way Sub-Committee, performed the opening ceremony.

Morecambe.—Mr. John Gardner, Corporation Tramway Manager at Chester, has been called in as a special adviser by the Borough Council of Morecambe, to give his opinion on the question of converting the tramway system there from horse traction to electric traction, also with regard to the purchase of the undertaking by the Corporation from a private company.

Nuneaton.—The Tradesmen's Association has asked the Coventry Electric Tramway Co. to extend its lines from Bedworth to Nuneaton.

Rotherham.—The year's working of the tramway undertaking shows gross profits amounting to £8,712 and net profits of £4,201, which it is intended to place to depreciation and renewals. Some 618,000 car-miles were run and 5,743,298 passengers carried, the latter representing an increase of 400,000 over the previous year.

Southampton.—The T.C. has had under consideration the conveyance of postmen on the tramways and the receipts received therefrom. It appears that nearly 1,000 journeys per day are made by postal officials, and the receipts amount to about ½d. per journey. It has been agreed to increase the present charge of £450 per annum for this service to £700.

South Africa.—JOHANNESBURG.—In commenting on the state of the local tramway service, as a result of the failure of the power plant, the *Financial Times* correspondent says: "The town is losing heavily in traffic; £1,500 was shed one week, £2,500 the next; these figures comparing with average receipts of nearly £5,000 in normal working. The car-miles run are about half and the number of passengers also just half those conveyed when things were normal."

With reference to gas leakages, he mentions that the general manager is suffering from gas poisoning, and that the chairman of the Tramways Committee was nearly "gassed" recently. It is further pointed out that an expenditure of over a million has been incurred on the new lighting and power plant and tramways, this sum including £168,150 on lighting plant and £219,700 on tramway plant at the power station. The guarantee on the gas-driven generating plant is joined with payments of about £150,000, and the penalty may reach as high as £200,000 if the plant and engines have to be abandoned. Obviously, in the latter case, further expense would accrue to the Corporation in alterations to buildings and foundations to fit the latter for new plant.

Mr. Bell, managing director of Messrs. Stewart, Mr. Ross, chief engineer of Messrs. Beardmore, the guarantors, and Mr. Dawbarn, one of the Council's consulting engineers, are about to investigate matters on the spot.

Southport.—A report on the past year's working of the tramway undertaking was presented to the Tramway Committee at the meeting on Monday, by the manager, Mr. Kendrew. The receipts, exclusive of rents, &c., from the leased lines, amounted to £18,463, against £17,230 in the previous year; and the working expenses were £11,225, or £465 in excess of last year's. The gross profit is £7,257, or £786 more than last year. Interest on capital will absorb £3,269, and sinking fund £3,843, leaving a net balance of £144. The number of passengers carried shows a considerable increase.

Southend-on-Sea.—The T.C. has applied to the B. of T. for an extension of time until July 4th, 1910, for completing the electric tramways in the borough.

Victoria.—MELBOURNE.—The State Cabinet recently decided that the Chief Commissioner for railways, Mr. Tait, should visit England to join with Mr. Bent in minute inquiries into the whole question of the electrification of the railways. The Premier and Mr. Tait will look into the question whether it has paid to convert steam into electric systems, and whether electric power is serving the purposes for which it is intended. If they find that electric traction is proving a success in England, then it is intended that the Premier shall appoint an English expert to report upon the conversion of the Melbourne suburban service.

TELEGRAPH and TELEPHONE NOTES.

Calcutta.—Good progress is being made with the reorganisation of the system of the Bengal Telephone Co. Over fifty miles of underground cables have been laid, containing 16,000 miles of wire. The common-battery system has been installed, and will shortly be put into service. The overhead wires in Calcutta are being entirely removed.

Post Office Telegraphs.—In the House of Commons last week the Postmaster-General stated, in connection with the accounts of the Post Office, that the increasing use of the telephone was adversely affecting the revenue not only from telegraphs, but also from letters and post cards. "In spite of, or in consequence of, this," the Post Office had extended the telephone system as far as practicable during the year, the mileage of wire having been increased by 78,000 miles. Both telephone and telegraph lines would be more quickly extended if the department were in a better position to overcome the obstruction of private individuals and public bodies in regard to wayleaves.

The underground telegraph system had been extended at a cost of £1,250,000 during the year.

The total revenue from telegraphs and telephones up to March 31st, 1906, was £4,410,269, of which £544,463 was paid to cable companies, and £4,060 was refunded. Royalties from the National Telephone Co. and other licensees amounted to £227,208, and the value of free Government telegrams was £62,423. The gross expenditure was £4,829,200, exceeding the revenue by £740,824.

Sydney-Melbourne Telephone.—The tenders of Mr. A. R. Coleman for constructing the New South Wales portion of the telephone line between Sydney and Melbourne have been accepted. The work is to be done at the rate of 45 miles per week, so that the contract, which covers 390 miles in all, will be completed within nine weeks from the time of commencement.

Swansea.—Difficulties have arisen in the course of the negotiations between the Corporation and the National Telephone Co. for the purchase of the telephone system by the latter, owing to the refusal of the Postmaster-General to assent to the sale, except on conditions which are not acceptable to the company. It appears that the P.M.G. will not agree to any payment in respect of goodwill.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Cayenne-Pinheiro	Aug. 13, 1902	..
Curacao-Coro, Curacao-La Guayra, Curacao-Maracaibo	Closed.. Jan. 12, 1906	..
Reissa-Issa and Reissa-Yemani (Yemen)	Oct. 22, 1902	..
Tarifa-Tangier	Jan. 18, 1904	..
Port Arthur-Chifu (Closed)	Mar. 9, 1904	..
Garachico-Santa Cruz	July 12, 1906	..
Las Palmas-Arecife	Aug. 18, 1906	..
New Brunswick-Prince Edward Island	Jan. 9, 1907	..
Dakar-Conakry	April 24, 1907	..
Gibraltar-Tangier	April 25, 1907	May 7.
Landlines.		
Puerto-Barrios	Aug. 28, 1902	..

CONTRACTORS' COLUMN.

Openings for new Business.

ABERGWYNFI, CYMMER.—Presbyterian church. A. L. Thomas, architect, Church Street Chambers, Pontypridd.

BANFF.—Converting Duff House (given by the Duke of Fife to the towns of Banff and Macduff) into a first-class Hydropathic. Burgh Surveyor, Banff, N.B.

BOLTON.—Thomasson Memorial Blind and Deaf Schools. F. Wilkinson, Director of Education, Nelson Square, Bolton.

BOURNEMOUTH (Southbourne).—Vicarage (£2,300). B. Livesay, architect, Bournemouth; Jenkins & Sons, builders, Bournemouth.

BRAMHALL (near Stockport).—New church of "St. Michael and All Angels." Architects, John Gibbons & Sons, Manchester.

BRISTOL.—Four electricity sub-stations. H. F. Proctor, electrical engineer, Temple Back, Bristol.

BURY.—Enlargement of Hope Foundry. Robert Hall & Sons, loom makers, Bury.

CONSETT (Co. Durham).—New public schools. W. H. Knowles, architect, 25, Collingwood Street, Newcastle-on-Tyne.

COVENTRY.—Grammar school to be extended. H. W. Chattaway, architect, Trinity Churchyard, Coventry.

CROMARTY (Scotland).—Additions to Gledfield House for Sir Kenneth Matheson. Messrs. Campbell, Inverness, builders.

CROYDON.—Parochial hall. F. Windsor, 7, High Street, Croydon, architect.

14 houses and shops. E. Bates, East Croydon, architect.

Houses, shops and stores on sites of 63, 65 and 67, High Street. A. Broad, 22, George Street, Croydon, architect.

DARLINGTON.—New public school (accommodate 420). G. Winter, borough surveyor, Darlington.

DEVONPORT.—New ward block at Infectious Diseases Hospital. J. F. Burns, borough surveyor, Ker Street, Devonport.

EAST HAM.—Factory for Burgoyne, Burbidges & Co., manufacturing chemists, 12 and 16, Coleman Street, E.C.

EPSOM.—Re-building Parish Church (£6,595). Benfield & Loxley, builders, Bullingdon Road, Oxford.

FALKIRK.—New property with offices, &c. H. Aitken, brewer.

Reconstruction of property in High Street for G. H. Burns, writer.

FOYERS (Scotland).—Manse. Cameron & Burnett, architects, Inverness.

GLOSSOP.—Dover mills to be extended. Olive & Partington, Ltd., Twin Lee Mills, Glossop.

HARPENDEN (Herts).—Manual instruction and cookery centre. U. A. Smith, county surveyor, Hatfield.

HASLINGDEN.—Rebuilding and extension of the Sykeside Mill. Architect, H. Ross, Accrington; contractors, Thomas Tattersall, Ltd., Haslingden.

HAYES (Middlesex).—Gramophone factory. T. Williams, Chairman, Gramophone and Typewriter Co.

INVERNESS.—Residence on estate of Mountcagle. Maitland & Sons, architects, Inverness.

LEIGH (Lancs.).—Important extensions to Spinning Mills. Tunnicliffe and Hampson, cotton spinners and manufacturers, Leigh.

Extensions to mills. T. & T. Hayes, cotton spinners, Victoria Mills, Leigh.

LITTLE HULTON (Near Bolton).—New coal mines being opened out. J. Roscoe & Sons, Peel Hall Collieries, Little Hulton.

LIVERPOOL (Wallasey).—Grammar School. Willick & Thickness, architects, Castle Street, Liverpool.

Extension of car-sheds at Liscard. W. H. Travers, engineer, Public Offices, Egremont, Cheshire.

LLANDOVERY.—Additions and alterations to Llanfair Grange, for Mr. B. Evans. C. Portsmouth, M.S.A., architect, Swansea.

LLANDUDNO.—New church (Lloyd Street), cost £3,780. Messrs. Huxley, builders, Malpas, Cheshire.

LONDON (Limehouse).—Alterations and additions to L.C.C. school (£12,209). C. Wall, Ltd., 4, Lloyd's Avenue, E.C., builder.

(Tottenham).—Rebuilding Tottenham and Edmonton Dispensary in High Road.

(Tottenham).—School in Belmont Road. G. E. T. Laurence, 22, Buckingham Street, Strand, W.C., architect.

(Tottenham).—Nine houses and shops in High Road, for the Governors of the Incorporated Society of Licensed Victuallers, 127, Fleet Street, E.C.

(Stonebridge, N.W.).—Music hall and public house. Mr. Saunders, 4, Coleman Street, E.C., architect.

(Hampstead).—Friends' Meeting House. F. Roundtree, 11, Hammersmith Terrace, W.

(Clapham).—Additions to Free House for Destitute Boys. C. E. Hutchinson, 29, John Street, E.C., architect.

(Oxford Street).—Picture gallery on the roof level of Waring and Gillow's premises. R. F. Atkinson, Brambleham, Acre Lane, Croydon, architect.

(South Kensington).—Office and workshops at Imperial Institute. H.M. Office of Works, Storey's Gate, S.W.

(W.C.).—Alterations and additions to Lepard & Smith's premises at Long Acre. Lewen Sharp, 3, Duke Street, Adelphi, W.C., architect.

(S.E.).—Store buildings at Peckham Rye, for Metropolitan Asylums Board. T. W. Aldwinckle & Son, 20, Denman Street, London Bridge, S.E., architects.

(W.C.).—Alterations, &c., to 8 and 10, Charing Cross Road, (electric light to be installed at estimated cost of £280). W. E. Riley, superintending architect, L.C.C., Spring Gardens.

LYTHAM.—Abbatoirs (£2,500). G. Myers, builder, Lytham.

MACDUFF (Scotland).—Villa for Mr. A. Robertson, banker. F. J. Robertson, architect, Keith.

MANCHESTER.—Bank Meadow Municipal Schools, Ardwick, to be extended. Education Offices, Deansgate, Manchester.

(Droylsden).—New works for the Co-operativeSundries Manufacturing Society, Ltd. A. J. Howcroft, architect, Retiro Chambers, Waterloo Street, Oldham.

(Cadishead).—New public hall for the Cadishead and Irlam Public Hall and Social Club Co., Ltd.

(West Gorton).—Baptist Church in Birch Street (£2,500).

MIRFIELD (Upper Hopton).—Club premises. J. Perry, architect, 3, Market Place, Huddersfield.

MONTROSE.—Proposed factory for North of Scotland Fish Guano Co.

NEWARK.—Public schools. G. H. Grocock, architect, Bedford.

NEWTON-LE-WILLOWS (Lancs.).—New technical school, to be built by the C.C. (£11,000).

PERTH.—Reconstruction of City Hall. Mr. Burnett, architect, Glasgow.

PONTYPOOL.—New church for Trevethin Parish (£5,000).

PONTYPRIDD.—New premises for Y.M.C.A. (£6,000).

PORT TALBOT.—Works, to be electrically equipped, for Messrs. Proud & Sons Cardiff.

PRESTON (Tardy Gate).—Co-operative stores and four houses. Mr. Munford, architect, 12, Guildhall Street, Preston.

RADCLIFFE (Lancs.).—New library, to be wired and fitted for the E.L. H. Lord, architect, 42, Deansgate, Manchester.

RAMSBOTTOM.—New Jerusalem Church and schools. Haywood & Harrison, architects, Accrington.

SHEFFIELD (Hillsborough).—New church and schools. H. Webster Norfolk Row, Sheffield, architect; Marlow & Sons, Hillsborough, builders.

STIRLING.—Proposed additions to Stirling High School. Mr. Walker, architect, Stirling.

Additions to St. Ninian's School. Mr. Simpson, architect, Stirling.

STOCKPORT.—New mill for Stockport Ring Spinning Co. (proposed). Write Managing Director.

WALLSEND-ON-TYNE.—New Town Hall buildings in High Street East. Franklin & Sons, 45, Manor House Road, Newcastle-on-Tyne.

WEST HAM.—Additions to Anglo-Continental Guano Works, North Woolwich Road.

WIDNES.—Secondary school to be built by Lancashire C.C. (cost, £14,000).

WILLESDEN.—Additions to biscuit factory for McVitie & Price, Willesden.

WREXHAM.—Presbyterian Church (£6,000). W. Beddoe Rees, architect, Cardiff; T. Ll. Davis, builder, Rhos.

Conciliation Board for the Engineering Trade.—According to the *Times*, representatives of the Engineering Employers' Association in North-East Coast Yards and of the Ironfounders' Association, met on 9th inst. in Newcastle-on-Tyne to discuss a proposal to establish a conciliation board for the regulation of wages and the settlement of trade disputes. It was resolved that such a board should be set up, and that, in the event of failure to arrange any dispute through the medium of the board, it should be referred to arbitration.

CONTRACTS OPEN and CLOSED.

OPEN.

Algiers.—June 1st. The Post and Telegraph authorities require tenders by June 1st. for supply of a multiple telephone commutator switchboard for the new G.P.O. Particulars from and tenders to Inspecteur-Général des Postes et des Telegraphes, 12, rue d'Uncont d'Urville, Algiers.

Bedford.—May 25th. Cables for 12 months. See "Official Notices" May 10th.

Belfast.—June 1st. Lighting switchboard and motor generator for the Corporation electricity station. See "Official Notices" to-day.

Belgium.—May 24th. Tenders are required for the installation of electric light in the Royal Museum of Antiquities and Armoury at the Porte de Hal. See note in this column last week.

Belgium.—The provincial government authorities at Liege recently invited tenders for the concession for the construction and working of an electric tramway in Spa from the railway station to Longue Heid, but no offers were received.

Bristol.—May 20th. A.C. and D.C. flame arc lamps for the Corporation. See "Official Notices" April 26th.

Cambuslang.—May 22nd. 70-KW. motor-generator; A.C. and D.C. switchgear; battery and booster for the electricity works extensions. See "Official Notices" May 3rd.

Dartford.—June 11th. Annual supplies (oils, meters, cut-outs, cable, stores, etc.) for the U.D.C. See "Official Notices" to-day.

Derby.—Bitumen insulated cable. See "Official Notices" to-day.

Ealing.—June 1st. One water-tube boiler for the electricity works. See "Official Notices" May 10th.

Knaresborough.—Tenders are being invited for the searchlight and telephones in connection with the carnival on August 15th next. Apply C. Hebblethwaite, Hon. Sec.

Hammersmith.—May 17th. Feeder and distributing mains and house service cable for the B.C. See "Official Notices" May 10th.

Hull.—May 23rd. One 500-KW. high-tension continuous-current dynamo and Belliss engine for the electricity department. See "Official Notices" May 10th.

Italy.—June 15th. The municipality of Trevi in the province of Perugia require tenders for a complete plant for electric lighting and power installation. No tender will be accepted unless at least two tenderers take part in the public adjudication which takes place on June 29th. Tenders must be sent in by June 15th to the Municipal Secretary, Signor I. Tabbarini. Local representation is advisable.

L.C.C.—June 11th. High and low-tension switchgear for five tramway sub-stations. See "Official Notices" April 26th.

Limerick.—June 11th. Stores of the Electricity Department. See "Official Notices" May 10th.

Nelson.—June 3rd. One Lancashire boiler with superheater and steam pipes. See "Official Notices" to-day.

Queensland.—June 24th. Supply Post and Telegraph Stores. Tender forms and specifications may be obtained, and patterns seen, at the offices of the Controllers of Stores, Brisbane, Sydney, Melbourne and Adelaide. Also four sections of a common battery switchboard, and 650 subscribers' telephones to Specification No. 145. See *Board of Trade Journal*, May 9th.

Spain.—The Spanish Post and Telegraph authorities have invited tenders for the establishment of a telephone line between Alicante and Elche.

Warrington.—May 21st. Economiser, tank, water softening plant for the electricity department. See "Official Notices" May 10th.

Whitehaven.—May 28th. Condenser, auxiliary plant, piping, etc., for the Electricity Department. See "Official Notices" May 10th.

CLOSED.

Ascot District.—The following is a list of the tenders for electric lighting plant, to the specification of Messrs. Handcock and Dykes, consulting engineers:—

TWO GAS DYNAMOS AND PRODUCER PLANT.

Bilbie, Hobson & Co. (Hornsby engines, Johnson & Phillips dynamos) (accepted)	£2,670
Johnson & Phillips (Hornsby engines and producers)	2,807
(Hornsby engines and "Mersey" producers)	2,557
(Premier engines and "Daniel" producers)	2,729
(Campbell engines)	2,952
Rawlings Bros. (Hornsby engines)	2,743
Siemens Bros. & Co. (Hornsby engines)	2,901
Phœnix Dynamo Co. (Stockport engines)	2,823
Mawdsley's, Ltd. (Stockport engines)	2,907
Schultz & Co. (Stockport engines, Crompton dynamos)	2,919
Farringdon Engineering Co. (Davey, Paxman engines, Newton dynamos)	2,950
(Hornsby engines, Newton dynamos)	2,806
Electric Construction Co. (Hornsby engines)	2,981

OVERHEAD TRAVELLER.

H. Morris & Bastert (accepted)	£157	Carrick & Ritchie	£219
Schultz & Co.	225	Schultz & Co.	260
G. A. Musker & Co.	235		

SWITCHBOARD AND BOOSTER.

Electric Construction Co. (accepted)	£863
Edison & Swan (plus £24 for specified instruments)	879
Rawlings Bros. (plus £23 12s. 6d. for specification work)	889
Hamilton Bros.	934
Farringdon Engineering Co.	948
Naider Bros.	963
Siemens Bros. & Co.	974
India-Rubber and Gutta-Percha Co.	993
Schultz & Co.	999
Johnson & Phillips	1,012
Prestwich & Burt	1,250

STORAGE BATTERY.

Tudor Battery Co. (accepted)	£931
(Maintenance per annum)	71
Rawlings Bros. (Pritchetts & Gold)	927
(Maintenance per annum)	70
Tudor Co.	931
(Maintenance per annum)	71
D.P. Battery Co.	998
(Maintenance per annum)	65
Chloride Electrical Storage Co.	1,020
(Maintenance per annum)	92

CABLES.

Siemens Bros. & Co. (accepted)	£9,444
Rawlings Bros.	9,468
Johnson & Phillips	9,552
British Insulated & Helsby Cable Co.	9,617
Schultz & Co.	9,718
Callender's Cable & Construction Co.	9,781
St. Helens Cable & Rubber Co.	9,924
Henley's Telegraph Works Co.	9,943

Barrow-in-Furness.—The Barrow Hæmatite Steel and Iron Co. have placed with Messrs. Veritys, Ltd., an order for a large switchboard for controlling 3,000-KW. generators and power circuits.

Bristol.—The Watch Committee of the T.C. has accepted the tender of the Post Office for 50 fire-alarm boxes of the best Gamewell type, with a closed circuit, to be grouped in six circuits, at £878 per annum for ten years, and £384 per annum afterwards. The council will supply the current required.

Croydon.—The Corporation has accepted the following tenders in connection with the electricity undertaking:—

E. Green & Son, Ltd., economisers	£696
W. Smith & Sons, flue and brickwork	£519
Babcock and Wilcox, Ltd., pipe-work	£145

Dublin.—The Dublin United Tramway Co. has placed an order with Messrs. Willans & Robinson, Ltd., for a 1,000-KW. steam turbine set, including alternator and electrically-driven surface condensing plant.

Glasgow.—The Electricity Committee of the T.C. has accepted the following offers for stores for the current year:—

Low-tension cables.—Callender's Cable and Construction Co., Ltd.
High-tension cables.—Lahmeyer Electric Co. and W. T. Glover & Co.
Wiring cables.—Craigpark Electric Co.
Flexibles.—Frankenburg & Sons, Ltd.
Oils.—Marks & Johnston.
Paints.—Blacklock and Macarthur.
Malleable-iron tubes and fittings.—Stewart & Lloyds, Ltd.
Meters.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.
Carbons.—Sloan Electrical Co. and the General Electric Co.
Wood-troughing.—Scottish Wood Haskenising Co., Ltd.
Cast-iron boxes.—Falkirk Iron Co.
Splint and Smithy Coal.—Flemington Coal Co.

Hull.—The E.L. Committee has accepted the tender of Siemens Bros. & Co. for the supply of cables, and that of Hedley, O'Brown & Co., for oils.

Kettering.—The U.D.C. has accepted the tender of Messrs. W. T. Glover & Co. for half a mile of cable at £300.

London.—At the meeting of the Metropolitan Asylums Board on Saturday, the following tenders were received for alterations and additions to the electric light plant at the Brook Hospital:—

J. H. Holmes & Co. .. .. (accepted)	£867
Electrical Power Storage Co., Ltd.	£385 10s.
Siemens Bros. & Co.	£436

L.C.C.—The Highways Committee of the L.C.C. has received the following tenders for the supply of six fuel economisers for the second portion of the Greenwich station:—

E. Green & Son (recommended) £3,805	Clay Cross Co. £4,033
A. Lowcock, Ltd... 3,910	Goodbrand & Co. 4,050
Roberts Bros. 3,967	

Ten firms have tendered for the delivery of 100,000 tons of coal for the Greenwich station. The lowest tender which complies with the specification is that of Wm. Cory & Son, at 14s. 5d. per ton, and this is proposed for acceptance for 25,000 tons at the same price, leaving the question of obtaining the remainder later on, when the market may become more favourable.

The undernoted tenders have been submitted for (1) electrically-driven ventilating fans for the Central School of Arts and Crafts in Holborn, and for (2) wiring the Tooting fire station:—

1.—Fans for Central School.

Alldays & Onions Co. ..	(recommended)	£693
Matthews & Yates		740
Musgrave & Co.		795
Davidson & Co.		841
Ashwell & Nesbit		938
Electric & Ordnance Accessories Co. ..		1,019
Standard Engineering Co.		1,033
A. W. Penrose & Co.		1,110
Electrical Co.		1,186
C. Pullan		1,245
Wilson-Wolf Engineering Co.		1,313
Sturtevant Engineering Co.		1,384
Rochdale Electric Co.		(incomplete)

2.—Wiring Tooting Fire Station.

W. J. Fryer & Co. ..	(recommended)	£140
Oliver Clark & Co.		166
Smeeton & Page		170
J. E. Spagnoletti & Co.		170
John Barker & Co.		175
F. A. Glover & Co.		178
Durell & Co.		186
J. O. Grant & Taylor		195

Oxford.—The Oxford Electric Co. have placed with Messrs. Bruce Peebles & Co., Ltd., a further order for a motor-converter, this making the third order for this type of plant.

Stretford.—A tender of the General Electric Co., Ltd., for a new 500-kw. set, for the sum of £2,908, has been accepted by the U.D.C.

Victoria (N.S.W.).—A contract has been let to Messrs. J. Bartram & Sons, as agents for Messrs. L. M. Ericsson & Co., Stockholm, for 9,000 telephone sets of the latest Ericsson type, costing about £27,000.

Wolverhampton.—The T.C. has accepted the following tenders:—

Babcock & Wilcox, Ltd., boilers, economiser and feed pumps, £5,622.
John Thompson, Ettingshall, steel chimney and feed-water tank, £765.
Willans & Robinson, Rugby, turbo-alternators and condensing plant, £1,214.
H. Gough & Son, Wolverhampton, extension of E.L. station, £2,900.
Electric Construction Co., Ltd., 500-kw. motor-generator, £1,484.

FORTHCOMING EVENTS.

Saturday, May 18th.—At 3 p.m. Junior Institution of Engineers. Visit to the scientific instrument works of Messrs. W. F. Stanley & Co., and to the Stanley Technical Schools, at South Norwood.

Thursday, May 23rd.—At 3 p.m. Royal Institution. Sir James Dewar on "Chemical Progress—Work of Berthelot, Mendeleeff and Moissan." (Lecture I.)

At 8 p.m. Institution of Electrical Engineers. Meeting at the Society of Arts, John Street, Adelphi, W.C. "The Present State of Direct Current Design as Influenced by Interpoles," by F. Handley Page and Fielder J. Hiss, students. "Hot Wire Wattmeters and Oscillographs," by J. T. Irwin, associate member.

Friday, May 24th.—At 9 p.m. Royal Institution of Great Britain. Discourse by Prof. J. A. Fleming on "Recent Contributions to Electric Wave Telegraphy."

At 7.30 p.m. North-East Coast Institution of Engineers and Shipbuilders. Paper "On Some Experiments on the Magnetic Character of Vessels," by Capt. W. Bartling, I.N.R.

Tuesday, June 18th.—Institution of Civil Engineers. Fifteenth "James Forrest" Lecture by Dr. Francis Elgar, F.R.S., "Unsolved Problems in the Design and Propulsion of Ships."

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are announced:—

Monday, May 20th.—Headquarters closed.
Tuesday, May 21st.—Headquarters closed.
Thursday, May 23rd.—"C" Company, technical drill, 7 p.m.
Friday, May 24th.—"D" Company, technical drill, 7 p.m.

J. H. S. Phillips, Captain, for Adjutant on leave,
Electrical Engineers R.E (V.).

NOTES.

Electrical Work and Conditions in Cuba.—Writing in the *Western Electrician* a few months ago on Cuban electrical matters, Mr. R. G. Grayne stated that there was a very effective system of signalling and transmission of messages by wire and telephone in service.

"There is a first-class electric power plant in Havana, and although they are squabbling concerning prices, the light is good and the plant is kept in order. Likewise there are good power plants for the operation of the electric car lines. Then there are wires for the carrying of messages, and wires for the telephone service. A great many modern devices have been introduced to build up and modernise the plants.

"Some of the difficulties of work in Cuba may interest. The clay is a sticky substance which clings to your shoes and makes travelling hard. It makes it difficult to sink a pole. You have to exert considerable pressure to get the point started. Then the first thing you know the point strikes a hard substance. There you quit, for you have contracted with the hard coral strata which prevails just below the surface of the earth. This coral strata causes the trees to topple over in the event of high winds, as the roots cannot get down into the ground very deep. With the fall of the trees the wires always get broken and tangled. Another thing that bothers the electric linemen of this country is the premature decay of wood in the ground. Poles are rotted off very quickly. The result is that steel poles are employed quite largely. Most of these metal poles are constructed of series of pieces, arranged in a tripod plan, extending upwards to the required height. The base of the pole is sunk into cement. Many of the wood poles are likewise cemented up at the foot, and the cement prevents decaying of the lumber. First the hole is made in the ground and then the base or foundation cement is put in. This is allowed to harden a little while, and then the base of the pole is put in. When erect the cavity is filled with cement. When dry and hard, a very substantial foundation and support is obtained for the pole. Electric linemen of Cuba are hindered to some degree by lack of supplies. Many of the appliances are shipped in from American manufacturing establishments. Delays and losses in shipping create more or less bother for the workmen. Then, again, there are the annoyances experienced due to the necessity of engaging a proportion of native help. While the average Cuban is a better worker than the Filipino, he has his disadvantageous qualities. The natives eat a little bread and drink a little coffee in the morning. They expect to quit promptly at 11 o'clock for breakfast, just when you are getting interested in your work and want to keep on. The whole gang stops, and you cannot get a thing done until 1 o'clock. Then they work until 6 o'clock. The Cuban lineman is agile and willing. He can go up the poles well, and he can work if he wants to.

"I have been asked questions concerning the likelihood of increased advantages for electrical men in this part of the world. Already some of our soldiers are arranging to purchase their discharges for the purpose of engaging in electrical work in this island. The electric lighting and power branches are occupying considerable attention everywhere, and the industry promises to be an exceedingly large one within a few years. Confidence has been restored in all lines of work. The planters are putting in more machinery. The electrical people are now placing orders for increased apparatus. More lights are being arranged for and additional electric railway lines and the like are in progress. There is a better demand for electrically-operated machinery. Telegraph and telephone lines are being developed. There are without a doubt increased opportunities for the electrical fraternity in this country, now that the American soldiers are here and quietude reigns."

More Rules for Motormen.—If the average motorman were law abiding, he would be the most perfect person (assuming that all laws are counsels of perfection) in the universe, for surely no other class of working man has had such a rain of little rule books to absorb. Was it not the manager of the Sandwich tramways who instructed his motormen with what sort of a graceful curve of their neatly gloved hands (for size and quality of gloves see Rule 17) they should "address" the controller handle preparatory to grasping it with the forceful purpose of the virile adult full of a grim determination to accelerate the car against all obstacles? This, indeed, was he who forbade his conductors to twine orchids in their hair, and discouraged them from offering, while on duty, their hands and hearts to the damsels of the district.

The Leicester Corporation Tramways Committee has issued over the signature of the engineer a book of rules and instructions to motormen, which is by no means the best of the large number of similar books we have seen.

Much of the material in it would be redundant after a *prospective* motorman had received his first lesson, and throughout the book the trained driver is treated as a creature almost lacking intelligence, upon whom real instruction would be wasted. The instructional value of the book is next to nothing, and we cannot insult the Leicester motormen by thinking that it will be of any interest to them. Any man who requires to carry about a book to remind him that the lights have to be turned on before they can blink when the car passes under a section insulator, or that the circuit-breaker (here irregularly named a canopy switch) must be in the position marked "on" before "current is free to flow," ought to go back to cleaning up the car shed. It is recorded solemnly that there are two controller handles, but the existence of field coils in the path which current takes through a car equipment is not mentioned, and the action of the rheostatic brake is explained as

being due to "the] energy of one motor opposing that of the other."

The statement that the rheostatic brake will not work if one motor is cut out is sufficiently misleading to cause accidents, and the next paragraph, reading "never reverse the controller to stop the car except when every other means of doing so has been exhausted. The canopy switch will certainly blow out if the car is travelling at any high rate of speed," is enough to puzzle any motorman who has been trained on other lines to believe that opening the circuit-breaker with the reversing handle on the backward notch, and the power handle in the parallel running position, carries an obscure danger with it.

The instruction to cause a panic, or at the least to exaggerate in the minds of passengers the danger of an earth on a trolley standard, by turning them out from inside as well as outside, seems an unwise one. If the trolley-pole is removed from the wire while outside passengers are accommodated inside, or asked to wait for the next car, and no further passengers are permitted to go upstairs, the car might run with as much safety as a single-decked car on which the trolley-pole is always alive, and the interests of the passengers and the tramway would be better considered.

The writer of this book would have done far more good if he had been a compiler and selector only, for there are a score of public and private books of rules and instructions which he could have adapted to his purpose, whereas he has produced something which must be positively injurious to the readers for whom it is intended.

Electricity in Medicine.—At the seventy-fifth annual congress of the British Medical Association, at Exeter, the President of the electrical section is Dr. H. Lewis Jones, London. The section will be opened on Wednesday, July 31st, by an address from Prof. Stephane Leduc. On Thursday a discussion on X-rays and sensitive plates will be opened by Mr. Mackenzie Davidson. On Friday a discussion on the dosage of the X-rays is to be opened by Dr. Sequeira. Papers will also be read by Dr. Lewis Jones (1) "Oscillograph Tracings of Medical Coil Currents," (2) "Ionic Medication in Ringworm"; Dr. D. Arthur, "A New Static Machine"; Dr. Hugh Walsham, "The Orthodiagraph"; Mr. E. W. H. Shenton, "The Examination of the Hip Joint"; Mr. E. Pearson, "The Use of X-Rays from the Point of View of the General Practitioner"; Dr. Ironside Bruce, "Treatment of Graves Disease by X-Rays"; Dr. R. Morton, "Alternating Currents of Slow Periodicity"; Dr. Stanley Green, "X-Rays and Chest Diseases"; Dr. Delprat Harris, "Some Statistics of X-Ray Therapeutics in Rodent Ulcer and Carcinoma"; and Prof. Wortheim Salamonson, Amsterdam, has promised to contribute a paper.

Electric Shock Fatality.—On Monday last, Mr. G. P. Wyatt, Coroner, held an inquest on the body of William Tomalin, aged 37, a stoker, employed at the South-Eastern Hospital, Old Kent Road, who met his death through a defective electric lamp. Mr. J. S. Cargill, engineer at the above institution, stated that he was overhauling the water valve in the pump room, and as he could not see very well he asked the deceased to bring the electric lamp which hung from a hook in the ceiling. In order to reach it deceased would have to mount a ladder to the platform at the end of the building. Witness heard the deceased go up the ladder and immediately heard a gurgling noise. Upon looking up he saw deceased on his knees, with some blood on his mouth. Witness ran to his assistance and inquired what was the matter, but received no answer. Another stoker caught hold of the deceased, and on doing so called out, "It is the electric light." Deceased was brought to the floor, and a doctor on arrival pronounced life extinct. He could not say whether deceased had the electric lamp in his hand when he first went up. Deceased was accustomed to the work. Nothing of a serious nature had previously gone wrong with the electric light plant.

Mr. T. J. Hogg, engineer-in-charge, said that, on being informed of what had happened, he went to the pump room, where he found deceased lying on the floor dead. Witness took the lamp (produced) into his possession. For about six minutes he tested it by twisting the cable, and it proved to have a slight temporary leak When he applied his finger to the spot it felt like a pin-prick. In reply to the coroner, witness said slight shocks had been experienced from the lamps on previous occasions, but there was nothing serious. The lamp and the wire were insulated. The lamp in question had been in use for about a month or five weeks only.

Dr. F. M. Turner, the medical superintendent, deposed that there were two small burns on the thumb and finger of deceased's left hand. He had a small abrasion on the lip, which would account for the blood. Deceased's clothes and boots were not damaged. The cause of death he attributed to syncope from an electric shock.

The jury returned a verdict of "Accidental death, such death being caused through a defective lamp."

Nationalisation of Swiss Waterfalls.—The question of preserving the power of the Swiss waterfalls for the economic development of the country has now reached a further stage, by the drafting by a commission of the Federal Council of a new article which it is suggested should be embodied in the Swiss Constitution. As far back as August last year a petition signed by 95,000 persons was presented, suggesting that the water-powers should be converted into a federal monopoly, but the commission which has since then investigated the question does not go quite so far as asked for in the memorial. As now proposed by the Federal Council, the article stipulates that the turning to advantage of the water-powers in Switzerland shall be placed under the superior supervision of the Swiss confederation. In order to protect the public interests and to ensure the suitable utilisation of the water-powers, regulations are to be prepared by the Federal Legislature in respect of the granting and the tenure of water-power concessions, as well as in regard to the transmission and sale of electrical energy. In so far as the Federal Legislature does not regulate the tenor of the concessions, this will be a matter for the Cantons, together with the fixing and the collection of the charges and imposts to be made for the utilisation of the water-powers. These imposts are not to render it materially difficult for the water-powers to be used. The use of water-powers which touch the districts of several Cantons, or the frontier of the country, is to be determined by the confederation, which will also grant the concessions and fix the charges and imposts to be made by the Cantons, after the latter have been heard on the subject. The sale of electrical energy obtained by the employment of water-power is only to take place abroad with the consent of the Federal Council.

A Petrol-Electric Locomotive for the Paris Underground Electric Railway.—One of the minor problems which the engineers of La Compagnie du Chemin de Fer Metropolitain de Paris had to solve was the method of conveying the men engaged in the upkeep and repair of the line, and the transport of the necessary material during the night, when the ordinary electrical energy was cut off from the track. After full consideration, it was decided that a self-moving vehicle would meet the requirements, provided it was capable of making two complete journeys in each direction of the line, without requiring any replenishing in the way of fuel, water, &c., and of hauling loads up to 10 tons at a speed of 25 kilometres, being, at the same time, of limited dimensions, and simply and easily managed. The idea of an accumulator-driven vehicle, notwithstanding its apparent simplicity, was rejected mainly on account of the cost of upkeep and the great weight of the battery, and a steam locomotive was considered undesirable, owing to the inconvenience caused by smoke. Finally the adoption of a petrol-electric vehicle, in which the power supplied by an internal combustion engine was transmitted electrically to the wheels of the machine, was decided upon. The frame of the vehicle is 19½ ft. long; it is built of channel steel, and is supported on four wheels of the ordinary Metro. pattern; the wheel base is 11½ ft., enabling all the curves on the line to be readily taken. The engine is a four-cylinder one, developing 32 H.P. at a normal speed of 1,500 R.P.M.; it is provided with accumulator and coil ignition, and water circulation by pump and radiator, in the same way as ordinary petrol road automobiles. The engine is coupled up to a four-pole dynamo, the field magnets of which comprise four exciting coils with double winding—one series and the other of fine wire, through which passes the current from a small battery of accumulators; the toothed armature is of the series drum-wound type, the commutator being mica-insulated, and provided with four sets of electro-graphitic carbon brushes. The electric motors, which are entirely enclosed, are of cast-steel; the field magnets, while having four poles, have only two exciting coils, wound in series. The double armature carries on the same core two windings connected up to independent commutators. The motors are much more powerful than the generating set, each being capable of normally developing 30 H.P., the reason for this provision being as follows:—There are four armatures, which, when the load is heavy and the speed is reduced, can be coupled in series. The whole current generated by the dynamo then passes through each armature, necessitating a heavy winding. On the other hand, when the machine is running light, and consequently travelling quicker, the armatures are placed in parallel. The control mechanism comprises a coupler, enabling the grouping of the motor armatures to be varied as necessary; a controller acting similarly on the fields; a lever controlling the forward and reverse motion; and an apparatus permitting either or both of the motors to be cut in and out of circuit as desired. The locomotive, which was built by Messrs. De Dion, Bouton & Co., of Puteaux, Paris, weighs 9 tons, and is capable of ascending grades of 1 in 6. We may add that no wood whatever enters into its construction, all danger of fire being thus excluded.

Car Lighting in America.—The use of an arc headlight has found much extension on interurban lines over which a clear view of the track for half a mile is necessary. The general practice is to connect this lamp, of the enclosed type, across the full line pressure of 500 to 600 volts with an iron wire resistance to absorb the superfluous energy. The writer of a paper read in Indianapolis, and abstracted in the *Western Electrician* for February, finds fault with this arrangement, and raises at the same time the whole question of car lighting. He points out that the arc uses, say, 380 watts, while the balance of 2,200 watts is wasted, and in addition to this another 1,200 to 4,000 watts goes in the ordinary lighting of the car, the number of lamps for this purpose varying from 20 to 65, according to the whim of the designer rather than to any actual study of the requirements. He would like to substitute glow lamps for the arc lamp resistance, but fears that the great variation of pressure on long feeders would render the lighting unsatisfactory, and suggests the attachment of a dynamo to the motor of the compressor which is used for the air-brakes. By this means the lighting voltage can be suited to the arc head lamp. From the point of view of economy this arrangement is much preferable to the existing state of things, but the feeder drop will be felt at the motor and dynamo terminals still, and the best results can be obtained only by using some system of the sort used on British and other railways in which the lighting pressure is kept constant through all ranges of speed, and does not depend on the line voltage at all. For simplicity the series-parallel arrangement of glow lamps in the arc lamp circuit with a cut-out across the arc is the best and ought to give fair results, but it cannot be economical, as the use of highly efficient lamps taking 1 to 1½ watts per

candle would imply lighting the interior of the car with about 2,000 C.P. If such an intense illumination were tolerated and enough head room could be found, it would be better to use a series of five or six arc lamps, each having a substitutional resistance but the very mention of it shows its absurdity, and brings us back at once to the best method of providing an independent low voltage lighting circuit. The utter folly of absorbing 2,000 watts for the sake of getting light with 300 is clear enough, and rather than spend any more in providing interior illumination, it would be better to take 700 watts for the purpose and waste only 1,300 watts in resistance. There would then be three 5-ampere arcs in series, and a few circuits of glow lamps, which could be switched in automatically if the arc circuit failed. In any case, the point need not trouble us much, as there is small likelihood of arc head lamps coming into use in this country.

Rare Metals.—While we should probably turn to our Latin neighbours for information on alloys, our chief source of concise statistics on pure metals is frequently Germany, and it is to a native of that country that we owe an interesting monograph on the above subject which recently appeared in the *Engineering Magazine*. The author, Mr. Schaaf-Regelman, reviews briefly the uses and prospects of the less widely known metals. Tungsten, or Wolfram, he tells us (producers United States and Australia), is in a fair way to become a common metal, 3,500 tons being produced during 1905. Its chief use is in the manufacture of Tungsten steel, which has the property of self-hardening in the air after forging, without the usual process of tempering.

Molybdenum (Canada and Australia) is used in steel in somewhat the same way. Although the production is still small (70 tons last year), one is pleased to note that, as the manufacture of molybdenum steel is less complicated than that of tungsten steel, the demand is likely to increase.

Vanadium and Uranium (Colorado) are also used in steel manufacture, principally at Essen. Uranium is of interest as the chief source of radium.

Titanium steel is claimed to be the coming material for wheels, axles, and rolling and crushing machinery.

Tantalum (Australia, Norway, Sweden, Russia, &c.) is an extremely hard substance, and resists corrosives to a remarkable degree. Its production has been greatly stimulated by the recent application to incandescent lamps.

Osmium. The osmium lamp, says the author, is more of scientific than of commercial value.

Thorium is principally extracted from monazite sand, which was, until recently, obtained wholly from Brazil. North and South Carolina have now entered the field as large producers of monazite sand. It is principally used for Welsbach gas mantles.

Zirconium and Yttrium furnish the main substance of the glower of the Nernst lamp.

Lithium, which exists in great quantities in the United States, appears to be used mainly in medicinal preparations, and at present is suffering from over-production.

Production of Copper in Norway.—It is stated in a recent trade report that the production of copper in Norway will shortly increase to a considerable amount, although only some 1,300 tons of the metal were manufactured during 1906. The sulphurous acid (oxide) required in the Norwegian sulphite cellulose factories is obtained, according to the usual method, by burning pyrites: and since a large proportion of the material so used is copper, it has been determined to lay down plant for the reduction of the burnt pyrites by a wet process. A factory will shortly be built at Soon, near Moss (a town a few miles out of Christiania), for the treatment of 45,000 tons of pyrites per annum.

Platinum in Russia.—At a recent Congress of members of the gold and platinum industries held in Russia, the opinion was expressed by a committee appointed to investigate the subject that platinum might probably be found to exist on the shores of the Gulf of Kandalaska (Kandalak) in the White Sea. The same view is held by several prominent Russian geologists. The committee also stated that the districts where platinum is already known to occur ought to be investigated systematically. The members felt that the erection of factories in Russia for refining crude platinum would be advantageous to the country, but decided that it would not be beneficial to the country to impose an export tax upon the material which is worked up abroad, or to raise the existing import tax on refined platinum.

Water-Power Installation at Los Angeles.—The new power house for the electrical transmission scheme between Los Angeles and Santa Barbara, now approaching completion, is situated on the banks of the Kern River. The initial generating plant will consist of four 5,000-KW. three-phase alternators with a frequency of 50 cycles when driven at 250 R.P.M. They will deliver current at a pressure of 2,300 volts, to 13 step-up transformers. The primaries of the transformers are arranged for delta connection, and the secondaries arranged for Y connection with connections for several different pressures ranging from 33,000 to 75,000 volts.

Fuse Tests at Deptford.—With reference to the report on the "Koolark" fuses tested at Deptford, which appeared in last week's REVIEW, the Electrical Apparatus Co. wish to point out that the tests referred to were on 550-volt continuous-current fuses. The statement that the London Electric Supply Corporation had, previous to the "Koolark" tests, been unable to obtain a fuse which would stand a 500-KW. short circuit, refers only to D.C. 550-volt fuses, and does not cover high-tension fuses, or in any way discredit the excellent results obtained by Mr. Partridge with his "Sparklet" fuses for high-voltage circuits.

British Electric Equipment Co., Ltd.—Meetings of creditors and contributories were held at Carey Street, W.C., on Tuesday, when Mr. H. M. Winearls, the Official Receiver, said that after deducting amounts due under the various contracts with Town and District Councils, and the amount of the debenture bonds, there was absolutely nothing left for the unsecured creditors or the shareholders. The deficiency in assets to meet liabilities was returned at £9,837, and the total deficiency to the contributories was estimated at £23,944. A report of the details is held over until next week. Resolutions were passed for the Official Receiver to act as liquidator, with a committee to assist.

Fatal Shock: Costly Joking.—A married man named Lingard (aged 24) was killed last week by an electric shock received from a wire which practical jokers had connected to the inside handle of a door of an engineer's shop at Sheffield. Death occurred ten minutes after the shock. The practical jokers were severely censured by the Coroner and jury, and a verdict of "Death from Natural Causes" was brought in. We have not the full details of the matter before us, but men who will indulge in such reprehensible and dangerous practical joking ought to be made, as far as possible, to bear the consequences of their act. The least they should do is to compensate the widow—but, perhaps, they come within the arm of the law apart from that.

Electrical Contractors.—The West Yorkshire Branch of the Electrical Contractors' Association met on Friday last at Leeds. Mr. E. C. Wallis, the secretary, reported an increase of 17 members.

Imperial College of Science and Technology.—The President of the Board of Education has presented a petition to the Privy Council for a charter for the incorporation of the new Imperial College, which, in the first instance, will not be affiliated to the University of London.

Electric Supply Football League.—A meeting was held (as announced) at the offices of the St. James' Co. on Thursday, May 2nd, with a view to forming an Associated Football League among the various electric supply undertakings of London. It was decided to adjourn until May 23rd, when a further meeting will be held at Carnaby Street, at 6·30 p.m., when, it is hoped, representatives of companies and boroughs within a 15-mile radius of Charing Cross, will endeavour to attend. Mr. S. Green, hon. sec. (*pro tem.*), 19, Carnaby Street, W., will be pleased to furnish any information required.

Electricity in the Italian Navy.—Our contemporary *L'Elettricita*, of Milan, published an interesting series of articles during the month of April, on the use of electricity in the Naval Service. Electric lighting was tried in quite the early days, and has been put to every practical use for signalling and other purposes; signals have been transmitted a distance of 50 km. with some of the powerful projectors, and for use at close quarters coloured glasses are introduced into the signalling code. Electric motors are applied to innumerable purposes, including that of driving the submarines, whilst for steering work, and again for raising the ammunition, they have almost entirely displaced the steam tackle. They are also widely applied in driving and steering torpedoes; since 1892 the cruiser *Capitano Prat* has been fitted with motors for giving the necessary elevation and swing to the heavy guns, whilst in the matter of ventilation, electric motors are of the utmost utility. In addition to many other uses to which they are put on board ship, they are used to close the dock gates after the boat has returned to harbour.

Efficiency Test of a Turbo-Alternator.—We have received the report of a test recently carried out on a Parsons 3,500-KW. turbo-alternator at Carville power station by the staff of Mr. C. H. Merz. The machine, which was one of four similar sets, had been at work for over six months, and was tested at loads up to no less than 6,922 KW., this load being maintained for half an hour. The generator was loaded with a water resistance. The results of the tests are summarised below; the speed was maintained constant at 1,200 R.P.M.:—

Duration.	Output in KW.	Steam. Pressure lb. per sq. in.	Steam. Superheat °F.	Vacuum.	Water. lb. per hour.	Water. lb. per KW.-hour.
½	Unexcited	180·0	80	28·87	3,670	—
½	Excited	211·0	61	28·95	5,206	—
1	2,193	202·4	103	29·04	31,836	14·52
1½	4,045	197·4	108	29·07	55,981	13·84
1½	5,901	195·8	117	28·95	79,455	13·46
½	6,922	198·4	118·5	28·76	94,780	13·69
1	5,164	199·9	120·5	29·04	68,180	13·19
3	5,059	194·5	92	29·19	67,853	13·41

The last test at 5000 KW., the most economical load, was carried out to verify the previous results; the slightly higher consumption was due to the less superheat. The results obtained, which in the case of the best—13·189 lb. per KW.-hour, equivalent to 7·85 lb. per I.H.P.-hour—are claimed by the builders, Messrs. C. A. Parsons & Co., to constitute a record over any other class of steam engine or turbine on the market, are undoubtedly very excellent. The actual output of the generator was taken into account, no deduction being made for any auxiliaries; the field current of the exciter was derived from an independent source, but apart from this the machine provided its own excitation.

Electro-Chemical Notes.—Electrolytic Gas in Sweden.—A paper was read by Herr F. Nielsen before a recent meeting of the Chemical Society of Stockholm, upon the factory which has just been built at Orebro, in Sweden, for the electrolytic production of hydrogen and oxygen and for the preparation of liquid air. The author stated that the gases made at this factory are already finding wide employment in the country, more particularly for the autogenous soldering or fusion welding of metals, and also for the production of the lime-light required in optical lantern work and in cinematograph entertainments. The hydrogen is also used for hygienic purposes. The public ambulance wagons in Stockholm all carry their own oxygen cylinders, the gas being employed in cases of carbon monoxide poisoning and the like. The Fire Brigade of Stockholm is also provided with cylinders of compressed oxygen, so that it may be able to afford first aid in cases of suffocation, while the men may be able to work in burning rooms full of smoke. The gases are subjected at the factory to periodical analysis in order to prevent accidents during the compression. For trade purposes they are compressed into steel cylinders at pressures of 120 atmospheres, the most usual sized cylinders employed for hydrogen having a nominal capacity of 35 litres, while those used for oxygen have a nominal capacity of 10 litres. The liquid air is prepared at the Orebro works by the Hampson method.

Calcium Carbide in Russia.—Attempts are being made by representatives of the Continental carbide trade to persuade the Russian Government to lower the import tax upon that material. It is generally considered that the present tax is unnecessarily high, tending to restrain the development of an industry that should prove valuable to the country at large. Many Russian locomotives and railway trains are lighted with acetylene, and it is thought that more would be fitted up in the same way, if carbide were not so expensive. Practically no carbide is manufactured in Russia itself, and Finland is outside the fiscal boundaries of the Empire.

Calcium Cyanamide in the Cultivation of the Sugar Beet.—According to a recent report by Strohmer, there is no doubt that the new artificial fertiliser, calcium cyanamide, is very useful in the cultivation of the sugar beet on the Continent of Europe; but he considers that further experiments on a large scale are still needed to ascertain the best method of applying it, and the cost of using it as a fertiliser in comparison with other artificial manures.

The Concentration of Iron Ores by the Gröndal Process.—Accounts have recently been published of the effect produced on treating low grade magnetic iron ores, containing 25 per cent. or less of iron, by the Gröndal process. The ore is first of all ground in a ball mill until it is reduced to the condition of fine sand. It is then introduced into a double Gröndal separator which, supplied with a current of 6 amperes at 120 volts, is capable of dealing with 70 to 100 tons of ore per day of 24 hours. In this manner a concentrate is obtained containing 60 to 61·5 per cent. of iron, an intermediate product containing 7 to 10 per cent., and a waste product containing 5 to 8 per cent. of iron. The concentrates are then compressed into briquettes without any agglomerating material and carried in trucks to the furnace, where they are heated with generator gas to a temperature of 1,300 to 1,400° C. The quantity of coal used to make the generator gas is about 7 per cent. of the weight of the ore, and the furnace is capable of reducing from 30 to 100 tons per 24 hours. In an experiment carried out some time ago at Herang, in Sweden, a crude ore containing 39·3 per cent. of Fe, 1·13 per cent. of S, and 0·006 per cent. of P, gave a concentrate containing 62·9 per cent. of Fe, 0·2 per cent. of S, and 0·003 per cent. of P. This gave briquettes containing 61·1 per cent. of Fe, 0·008 per cent. of S, and 0·003 per cent. of P; and the pig iron reduced from them contained 0·005 per cent. of S, and 0·012 per cent. of P.

McDonald Electrolytic Bleach and Caustic Soda Plant.—The art of producing caustic soda and chlorine gas to satisfy the great diversity of its uses, has demanded the attention of the best talent in the chemical and electro-chemical field. America, unhampered by obsolete methods and with unlimited resources for producing cheap power, was ripe for the introduction of electro-chemical methods to improve upon the general chemical industry. As a consequence several systems have been developed for the production of caustic soda and chlorine gas to meet the ever-increasing demand. Economy of maintenance and operation, and high efficiency are the potent factors, an illustration of such being furnished in the plant installed by the McDonald Electrolytic Co. for the New York and Pennsylvania Co., at their paper mill at Johnsonburg, Pa. It has a capacity of 16 tons of bleaching powder and 6½ tons of caustic soda per day, and has been successfully operated for one year.

The engine and switchboard rooms are floored and walled with tiles, and all exposed iron work is coated with white enamel. The generating units are direct current, compound-wound generators, constructed so that each will operate without sparking at a voltage varying from 150 to 270, and capable of supplying 2,000 amperes to the cell sets arranged in series-multiple. These are driven by vertical, cross-compound condensing engines, with a rating of 750 H.P. at 100 lb. steam pressure at the throttle. The switchboard is constructed to operate the cell units independently with a separate ammeter for each unit. The auxiliary machinery for lighting and driving agitators derives its power from the main supply. The cells are located in the higher floors of the building, the second containing 250 cells and the chlorination towers, to which the gas is delivered under slight suction, and the third 350 cells. These cells are connected in series-multiple of 50, and are interchangeable at the switchboard. On the floor below are situated the bleach liquor tanks, capacity 72,000 gallons, the brine mixers and storage tanks. The brine solution is supplied to the cells automatically, and the products are handled without undue expense. The chlorine gas is absorbed in milk of lime, and is circulated until the required strength is obtained. It is thereupon delivered to the point of consumption by means of a system of piping and rotary pumps. The concentration of the caustic soda solution in the cell rises to 15° B., and is conveyed to an ordinary evaporator. With 5 lb. steam pressure, the concentration reaches 45° B., and the salt is eliminated. Thus, a complete system is established from start to finish. Repairs and replacements are low, the cells being run for eight months undisturbed, at the end of which time new anodes only are required.—*Electro-Chemical and Metallurgical Industry*, Vol. V, No. 2.

The Girod Ferro-Alloys Works and the New Girod Steel Furnace.—An account (*Electro-Chemical and Metallurgical Industry*, Vol. V, 1) of a recent visit of Dr. Hutton to the above works, gives some very interesting details of the production of ferro-alloys by the new electrolytic process. The company—Société Anonyme Electro-métallurgique—is now in possession of three important works, viz., at Ugine, in Savoy, at Courtepin and at Montbovan, in Switzerland, and uses 18,000 H.P., but the harnessing of further power is rapidly progressing, and shortly some 45,000 H.P. will be available. A start was made in 1890 with a 28-H.P. plant, followed in 1899 with 1,000 H.P. In 1903 the works at Courtepin were commenced with 1,800 H.P., which was rapidly increased to 5,000 H.P., electrical energy being obtained at 16,000 volts pressure from the Government. In the same year water rights were purchased and the installation of a power plant of 8,500 H.P. at Ugine was completed and made available before the expiration of 1904. The head is 125 metres, the water being conveyed from the barrage through a tunnel 3 kilometres long, and then by steel conduits each 1·32 metres in diameter and 550 metres long. The power house contains nine 600-H.P. and nine 300-H.P. Neyret-Brenier turbines, driving six 600-H.P. and nine 300-H.P. continuous-current machines and three 600-H.P. alternators. The furnace house is equipped with the smothered-arc type of plant, provided with automatic regulation and all the equipment necessary for continuous work. At the present time the annual output of the three works is, 5,000 tons 50 per cent. ferro-silicon; 1,000 tons, 30 per cent. ferro-silicon; 2,000 tons ferro-chromium; 1,000 tons ferro-tungsten; 50 tons ferro-molybdenum; 10 tons ferro-vanadium, the total being equivalent to some 9,000,000 fr. per annum. The Société specialises in high grade alloys of low carbon content. These products find a ready sale not only in France, where the development of "ternary" and "quaternary" steels has had an earlier success than in most countries, but also in Germany, Austria, England and even America. The ferro-tungsten can be classed in two grades—the one containing about 85 per cent. W, and less the 0·5 per cent. carbon, and used for the manufacture of crucible tool steels, the other containing 60-70 per cent. W and 2-3 per cent. carbon, and used in the production of open-hearth steels for springs, &c. The older form of furnace devised by Girod has now been abandoned, and a newer one introduced. This is of the arc type, and employs a single vertical electrode. The metal in the hearth of the furnace is covered with slag, and the arc is struck across this to the electrode, which maintains the heat. The molten metal is connected to the other pole of a dynamo by means of a series of water-cooled steel bars sunk in the refractory lining of the base of the hearth. As in the Héroult furnace, the superposed layers of slag are of such composition as is required for the refining of the metal, and are renewed from time to time. The charge is 1½ tons, and the power 350 H.P. The latter consumption is low. The present furnace is of interest, due to the simplicity of design and the ease with which the automatic regulation can be effected. This type is also used for the reheating of small ingot steel. In this case a multiple crucible furnace contains the ingots, the chamber being surrounded by the resistance material, consisting of ferro-silicon and carbon. This method is worthy of consideration, for in the old-fashioned, but still largely employed type of reheating furnace, the waste of fuel is enormous.

A Simplified Galvano-Plastic Process.—It is usual in a galvano-plastic process to place the object to be covered in a bath of suitable electrolyte, the containing vessel being of a size appropriate to the article, and the current being allowed to pass until a suitable thickness of metal has been deposited. This method cannot be employed, however, when dealing with a very voluminous cathode. When a thin deposit is required, the following method has been employed with success:—The bath is replaced by a small quantity of electrolyte contained in a brush. This latter makes metallic contact with the source of the current, making connection along the outside edge of the brush. The object to be covered is connected with the other pole, and the deposit is formed by painting. In this way an adherent cover may be developed, the thickness depending on the number of strokes made. The author, M. R. Goldschmidt, uses the current from the mains supplied at 110 volts with a lamp resistance of 750 ohms interposed. The current is about 0·1 ampere. The solutions used are constituted as follows:—

1. Silver.—Silver nitrate, 20 grammes; potassium cyanide, 30 grammes; ammonia (strong), 0·4 gramme; potassium pomate, 2 grammes; water, 1 litre.

2. Gold.—Chloride of gold, 6 grammes; ammonia, 2 grammes; potassium cyanide, 13 grammes; water, 1 litre; potassium pomate, 2 grammes.

3. Copper.—Copper sulphate, 180 grammes; sulphuric acid, 60 grammes; water, 1 litre; alcohol, 10 grammes.

4. Nickel.—Nickel sulphate, 60 grammes; sodium sulphate, 20 grammes; sodium citrate, 20 grammes; water, 1 litre.

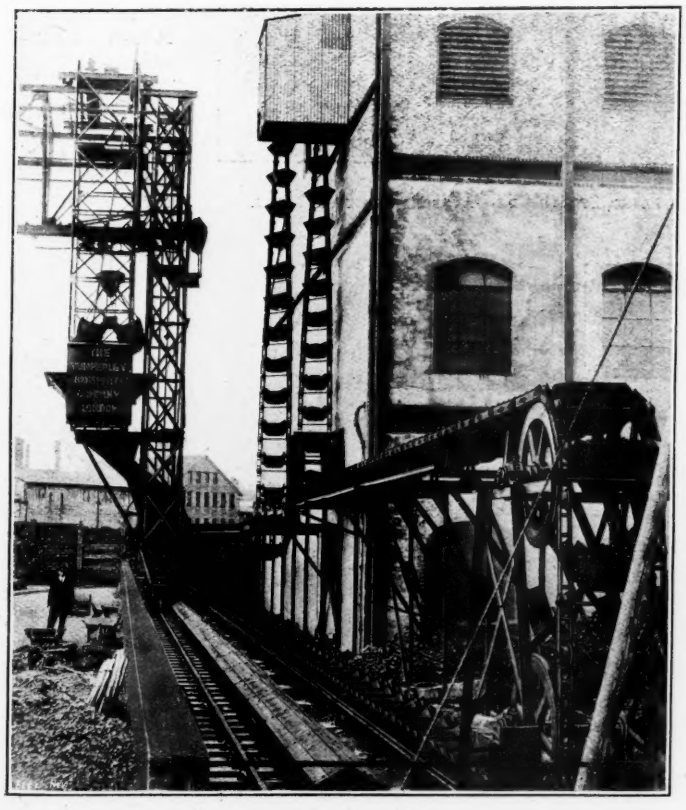
In the case of nickel it is advisable to use a low voltage, not exceeding 4 volts.—*Revue de l'Electro-chemie et de l'Electro-metallurgie.*

(*Continued on page* 811.)

ELECTRICALLY-DRIVEN TRANSPORTER AT THE BOURNEMOUTH GAS AND WATER CO.'S WORKS.

An interesting installation has recently been erected by the Temperley Transporter Co., at the works of the Bournemouth Gas and Water Co. at Poole Harbour. This plant is for discharging coal in bulk from vessels and railway trucks, by means of grabs, and delivering it for storage or to a gravity bucket conveyor for supplying the coal bunkers in the retort house. The structure is in the form of a lattice bridge of triangular section, with a clear span between the supporting frames of 180 ft., reaching across the whole storage ground, and with a cantilever extension with hinged extremity, 92 ft. in length, extending over the quay and a public road. The front, or waterside, frame carries the whole of the hoisting and transporting machinery in a closed-in house, and also the driver's cabin, in an elevated position, from which one man who controls all the operations of the transporter, has a full view of everything. The back, or inshore frame, carries a coal crusher, with a hopper and conveyor feeder, through which all the coal is passed as it goes to the conveyor. The whole transporter is mounted on wheels running on rail tracks under each supporting frame. A hopper weighing machine is carried on a frame suspended from the bridge, and arranged to be readily moved over the stock heap or coal crusher-hopper, or in fact, to any point on the storage ground. When it is required to discharge coal from a vessel, the transporter is moved along into a position opposite a hatchway, and the hinged arm lowered, but otherwise the position of this arm does not affect the working of the transporter. The gravity bucket conveyor is laid along the rear track of the transporter, and is carried up over the retort hoppers, into any of which it automatically delivers the coal. Although the transporter is specially adapted for working with a grab, this can readily be removed and turn-over skips used. A special automatic fall-block and skips have been provided, but these are seldom used as experience has shown that under practically all conditions the grab gives better and more economical results.

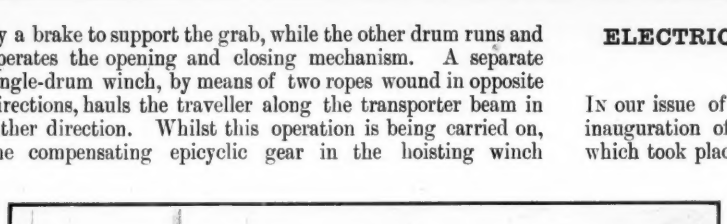
Electrically-Operated Transporter, Bournemouth Gas and Water Co.'s Works.



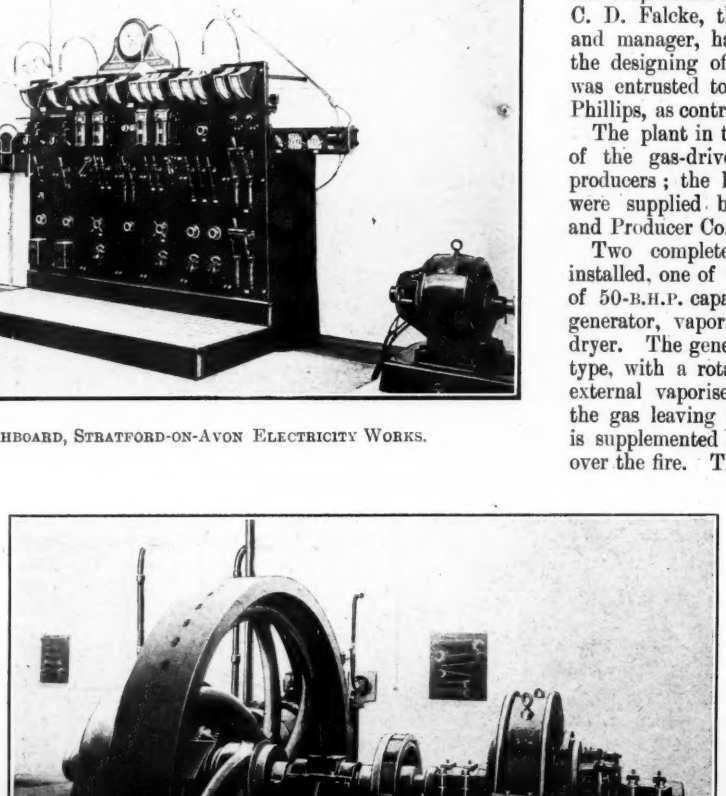
View showing Transporter Feeding Retort House Conveyor.

Electric lights are distributed over the transporter bridge and cantilever for illuminating the site during night operations. In order to facilitate working at night and during foggy weather, a special indicator —which is practically a reduced scale model of the transporter—is fitted in view of the driver. On this indicator the traveller, grab and weighing-machine move automatically in exactly the same manner and in harmony with the actual parts which they represent, thus enabling the driver to operate the transporter without seeing the actual operations. The whole of the machinery is electrically driven, energy being picked up from a pair of conductors run in a conduit parallel to the conveyor, and led in cables along the bridge to the machinery house on the top of the waterside supporting frame. A double-drum winch lifts and lowers the grab by two ropes, one from each drum. These drums are connected by a special epicyclic gear arranged so that both drums can be run together to lift and lower the grab, or one drum held

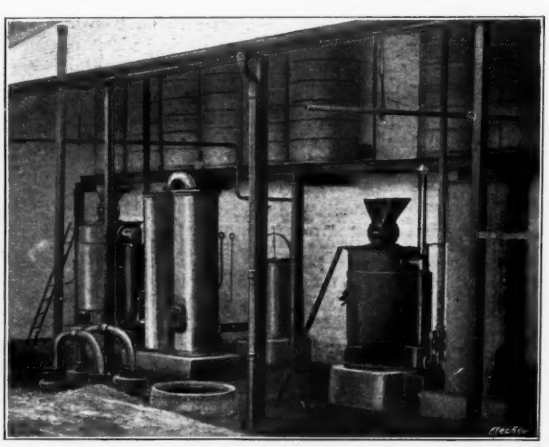
by a brake to support the grab, while the other drum runs and operates the opening and closing mechanism. A separate single-drum winch, by means of two ropes wound in opposite directions, hauls the traveller along the transporter beam in either direction. Whilst this operation is being carried on, the compensating epicyclic gear in the hoisting winch causes its two drums to revolve in opposite directions, hauling in one hoisting rope and paying out the other, so as to maintain the load at a uniform height as it moves along the beam, unless its height is intentionally varied by the driver. The operations of hoisting and lowering and that of transporting can be carried on at the same time, without either in any way interfering with the other. A considerable saving of time is thus effected, as the load can be moved along any desired trajectory and at any speed at the will of the operator. At the same works there has also lately been installed one of the "Temperley" patent radial transporters, for delivering the coke from the retort house into storage hoppers.



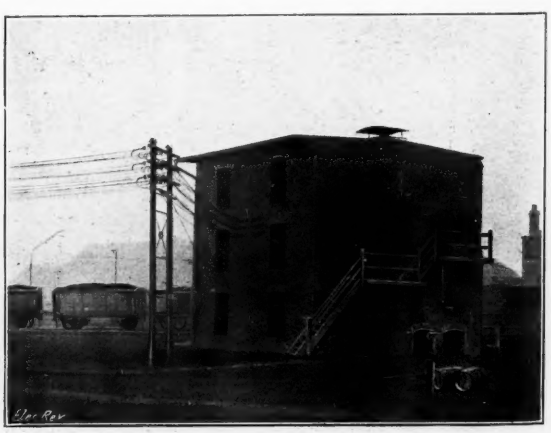
THE SWITCHBOARD, STRATFORD-ON-AVON ELECTRICITY WORKS.



GAS-DRIVEN GENERATING PLANT, STRATFORD-ON-AVON ELECTRICITY WORKS.



PRODUCER PLANT, STRATFORD-ON-AVON ELECTRICITY WORKS.



SUB-STATION WITH OVERHEAD TRANSMISSION FOR CEMENT WORKS PLANT. [See following page].

ELECTRICITY SUPPLY AT STRATFORD-ON-AVON.

IN our issue of the 3rd inst. we briefly recorded the official inauguration of the Stratford-on-Avon electricity supply, which took place on April 27th.

The undertaking is under the ægis of a local company, which has acquired the Corporation's powers of supply. Mr. C. D. Falcke, the company's engineer and manager, has been responsible for the designing of all the work, which was entrusted to Messrs. Johnson and Phillips, as contractors, to carry out.

The plant in the generating station is of the gas-driven type, with suction producers; the latter, with the engines, were supplied by the Mersey Engine and Producer Co., of Liverpool.

Two complete producer plants are installed, one of 80-B.H.P. and the other of 50-B.H.P. capacity; each comprises a generator, vaporiser, washer, filter and dryer. The generator is of the circular type, with a rotary stoking valve. An external vaporiser is fitted, heated by the gas leaving the generator, and this is supplemented by a coil-type vaporiser over the fire. The combination of these two vaporisers enables the plant to evaporate 1 lb. water per B.H.P.-hour, thus giving a high value to the gas. The coil, in conjunction with an evaporation plate under the fire, enables considerable load fluctuations to be met.

The engines are of the Stockport type, built by Messrs. Hornsby, and specially designed for direct coupling to dynamos.

Each engine is fitted with L.T. magneto ignition, variable as to timing; governing on the "hit and miss" system; forced lubrication to the piston; and a petrol pump for starting up with an initial petrol and air charge.

The two engines are coupled by means of flexible belt-type

couplings to a 50-KW. and a 25-KW. 440-volt D.C. generator respectively, supplied by Messrs. Johnson & Phillips, who also supplied the switchgear, cables, &c.

These machines are of the interpole type, and specially ventilated with a view to securing good commutation and cool running.

There are also installed a balancer set consisting of a 4-KW. 230-volt machine, capable of dealing with 35 amps. out-of-balance current, and a booster consisting of two machines with an output of 90 amps. up to 150 volts pressure, driven by a motor. The booster works in conjunction with a 220-cell "D.P." battery of 300 amp.-hours' capacity. The seven-panel switchboard, shown in our illustration, provides for the control of the plant above mentioned, together with two outgoing feeders, the switchgear being of standard type.

The system of supply is a three-wire one, with 440 volts across the outers. The feeders are of the triple-concentric and concentric types, paper-insulated and lead-covered, and laid solid in wooden troughing.

The distribution and pilot cables are of the vulcanised bitumen type. Three feeder pillars are erected at various points in the town, the distributor cables leading out through switch fuses.

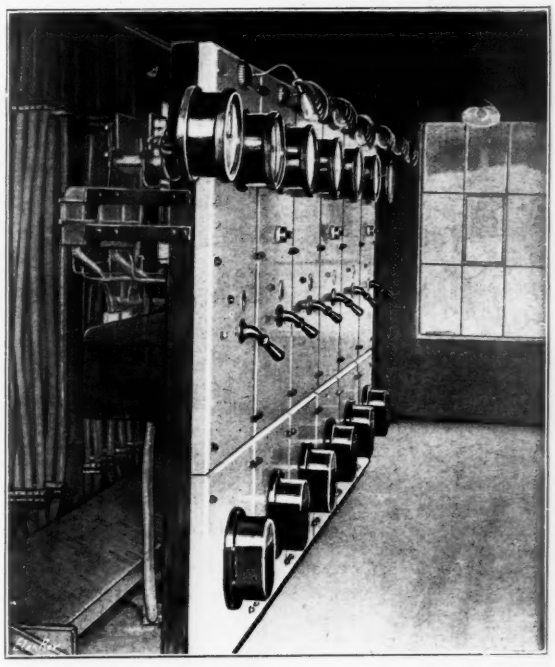
Up to the present some 2500 yds. of feeder and 6,000 yds. of distributor cable have been laid.

In conclusion, our thanks are due to Mr. Falcke for the particulars and illustrations here given; to him and his company we wish all success in their enterprise.

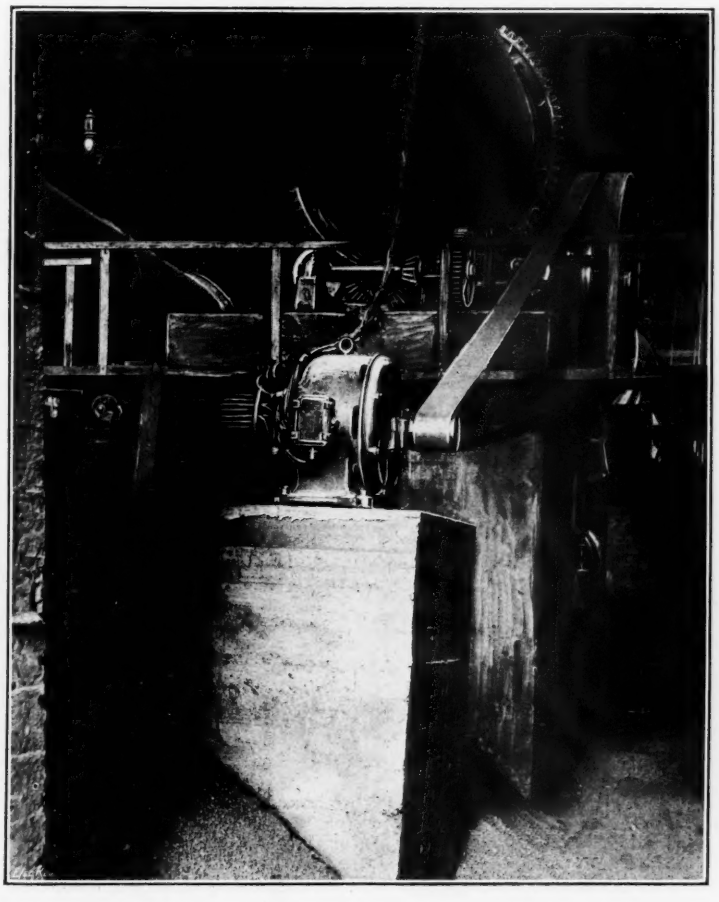
ELECTRICAL DRIVING IN A HARTLEPOOL CEMENT WORKS.

SOME few months ago we were enabled, through the courtesy of the British Westinghouse Co., to give full particulars of the electrical equipment of an important American cement making plant (see ELEC. REV., Nov. 23rd, 1906).

It is, therefore, with added interest that we append the following details of the electrical equipment of a similar British undertaking, *i.e.*, Messrs. Casebourne & Co.'s Works at Haverton Hill, West Hartlepool, the plant in this case also being of Westinghouse make.



SWITCH PANELS IN SUB-STATION FOR CONTROLLING CEMENT WORKS CIRCUITS.



ELECTRIC DRIVE TO ROTARY KILN, MESSRS. CASEBOURNE'S CEMENT WORKS.

Up to a few months ago the entire cement-making plant was driven by oil engines, which have now been superseded by three-phase induction motors. The directors of the company first entered into a contract for generating plant, but this was subsequently cancelled in favour of an arrangement with the Cleveland and Durham Electric Power Co. for a supply of energy direct. The installation is particularly interesting as being the first cement plant in this country to be electrically-driven throughout.

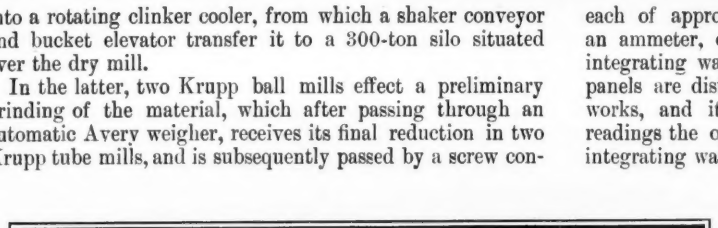
To understand the scope for electric driving in such a works, some brief reference is necessary to the processes employed. Of the raw materials used, *i.e.*, chalk and clay, the former is imported by sea from Kent, and on arrival is crushed in two elevated crushers, and mechanically conveyed to wash-mills where local clay is intermixed in the proportion of one-third, by the aid of water.

The liquid mixture obtained from the wash mills, termed slurry, is carried by a bucket elevator into adjoining tube mills, where it is finely ground. From the tube mills the slurry is pumped through underground pipes, by means of a three-throw 10-in. pump, into a large ferro-concrete mixer holding about 200 tons, in which it attains an even consistency, prior to being again pumped up to the nose or entrance of each of four rotary kilns.

In passing through the latter it is converted into clinker, and discharged

into a rotating clinker cooler, from which a shaker conveyor and bucket elevator transfer it to a 300-ton silo situated over the dry mill.

In the latter, two Krupp ball mills effect a preliminary grinding of the material, which after passing through an automatic Avery weigher, receives its final reduction in two Krupp tube mills, and is subsequently passed by a screw conveyor system to a packing warehouse of some 6,000 tons capacity.



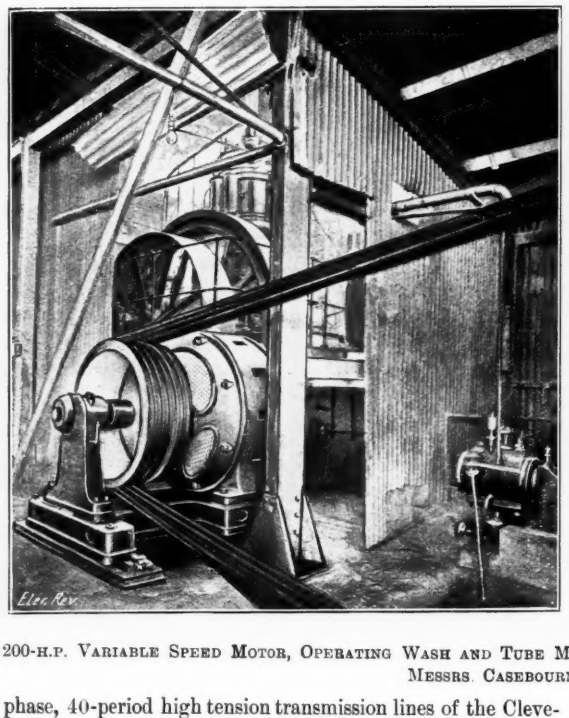
Polyphase Motors Driving d c. Generators for Operating the Jetty Conveyor at Messrs. Casebourne's Works.

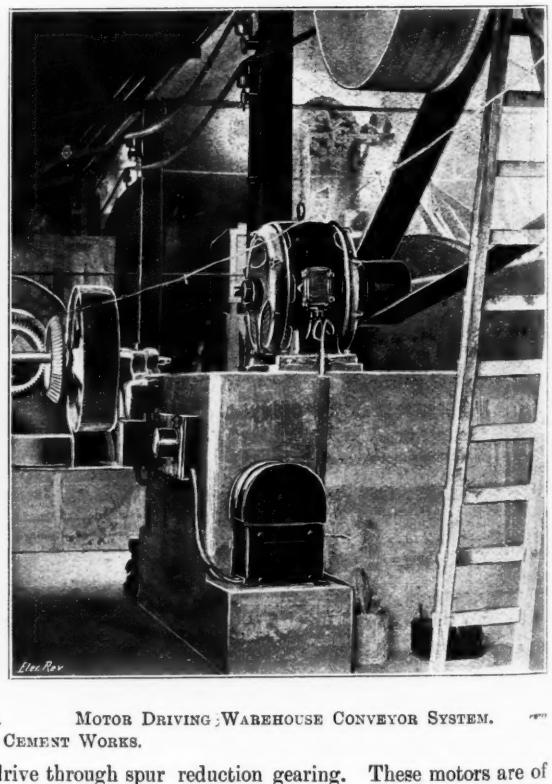
The coal required for the rotary kilns is dried by means of hot air, and subsequently finely ground in two ball and two tube mills of a similar pattern to those used for clinker reduction. This powdered fuel is conveyed to four hoppers adjacent to the kilns for supplying the coal feed fans, the latter blowing the fuel, together with hot air from the clinker coolers, into the kilns, where the intense gas-like flame produced, results in the calcining of the slurry.

We now turn to the electrical equipment. The three-phase, 40-period high tension transmission lines of the Cleveland and Durham Electric Power Co. are brought from Grangetown, a distance of 13 miles, into a sub-station at the works, where the current is transformed down from 11,000 to 440 volts pressure.

A Westinghouse L.T. switchboard is erected in the sub-station, and consists of six white marble panels, each of approximately 150 KW. capacity, and fitted with an ammeter, oil-break switch, lightning arrester, and an integrating wattmeter. The motors controlled from these panels are distributed in the six different sections of the works, and it is easy to calculate from the wattmeter readings the operating expenses of each section. A large integrating wattmeter, fixed on the wall immediately facing the switchboard, gives the total consumption of electrical energy taken from the power company's mains.

The whole of the alternating current motors are of the Westinghouse induction type, and, excepting three of 50 H.P. capacity, are provided with wound rotors and slip-rings, so that resistance can be introduced into the rotor circuits when starting. The wash mills and tube mills, in the wet mill department, are driven by a 200-H.P. variable-speed motor. They were originally driven by the oil engine seen at the rear, and a comparison of floor space between the old and the new is not without interest. This engine occupies practically 570 sq. ft., and the water-cooling plant 855 sq. ft., whilst the motor occupies but 45 sq. ft. There is another important advantage afforded by the electric drive in this department. Should the wash mills be shut down for an appreciable period, the slurry practically solidifies around the interior frame, which circumstance, together with the heavy nature of the machinery, makes a large torque at starting essential. As the 200-H.P. induction motor is designed for a starting torque of not less than twice the full load running torque, the advantage is obvious. In the rotary kiln house there are four 15-H.P. motors, each mounted on a concrete pedestal and driving a rotary kiln, the method of rotating the kiln being by belt drive through spur reduction gearing. These motors are of the variable-speed type, and are capable of giving their full-load torque at any speed between 400 and 800 R.P.M., the speed being varied to suit the amount of slurry passing through the kiln. The line shaft in the kiln house is driven by a 100-H.P. motor, and operates the slurry pumps —between the 900-ton mixer and the kilns—the clinker





200-H.P. Variable Speed Motor, Operating Wash and Tube Mills. Motor Driving Warehouse Conveyor System. Messrs. Casebourne's Cement Works.

coolers and the shaker conveyor. This latter feeds into an inclined bucket elevator, operated by a 15-H.P. induction motor; the elevator leads into the dry mill, where the ball and tube grinding plant is driven by two 200-H.P. motors. This mill was originally operated by two large oil engines, still to be seen; one of them a good object-lesson of a severe crank-shaft "smash." The drum type controller employed has nine starting notches, and the current carrying portions are fitted with cheap copper tips, which may be renewed when arc deterioration and wear render this necessary. The screw conveyors leading from the dry mill to the warehouse are operated by a 50-H.P. motor, and the coal-crushing plant is driven by a 150-H.P. motor.

Besides those already referred to, there are two 50-H.P. motors driving direct-current generators. These latter are for lighting and for supplying direct current to the 20-H.P. motor operating the jetty conveyor, a small motor in the chemical laboratory, and a 7½-H.P. motor driving the fitting shop, which were in use before the new electrical plant was installed.

All the alternating-current motors are of the semi-enclosed type, with open stator slots, and coils so arranged as to be readily interchangeable in case of accident. The guaranteed full load efficiency of the 200 and 150-H.P. motors is 92 per cent., of the 100-H.P. motor 90 per cent., and of the 50 and 15-H.P. motors 87 per cent. and 85 per cent. respectively.

The aggregate capacity of the motors recently installed, is near 1,100 H.P., and it may be of interest to note that from 3½ to 4½ million B.O.T. units will be required per annum, which amount should form a valuable load on the Cleveland Power Co.'s mains.

The severe operating conditions existing in cement works are fairly well known; the heavy torque required to start the cement-making machinery, the nature of the load handled, the constant presence of dust, and the inflammability of pulverised coal, render the conditions of service most onerous. In the face of these facts, however, the advantages which have been afforded by electric driving, have greatly extended the manufacturing limits of Messrs. Casebourne's works.

We are indebted to Mr. F. T. Tristam, the managing director; to Mr. W. J. Coles, of Messrs. Maxted, Knott and Coles, consulting engineers; and to the British Westinghouse Co., for the particulars here given.

NOTES.

(*Continued from page* 806.)

Appointments Vacant.—Shift engineer (£150) and boiler house foreman (£2 5s.) for Birmingham electric supply department; switchboard attendant (30s.) and fitter (30s.) for the Barnsley Hall Asylum; assistant mains superintendent for Rochdale (£78).

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (GLASGOW SECTION).—The annual report of the Committee shows that there has been an increase of 49 in the membership, which now totals 279; 34 of the new members fall to the class of students. Regarding the visit of foreign societies, the Committee announces that a most interesting memento has been received jointly from the Verband Deutscher Elektrotechniker and the Elektrotechnischer Verein, of Berlin, in the form of a bronze medallion of Werner von Siemens. The names of the office bearers for the session 1907-8 have already been published. Mr. Tidd, who has been secretary almost from the formation of the local section in 1899, has found it necessary to relinquish this position, and the Committee records its high appreciation of the manner in which Mr. Tidd carried on the duties of honorary secretary and treasurer. The number of students in the Glasgow Section has increased from 36 at the beginning of the first session to 70 at the end of March.

On Tuesday, May 14th, the annual general meeting of this Section was held, and it was followed by an ordinary meeting, at which a paper on "A New Leading-in Conductor for Electric Lamps" was read by Mr. C. Orme Bastian. At the conclusion of the discussion, Mr. W. W. Lackie showed a series of lantern views of the Glasgow Corporation electrical undertaking, and gave a short description of same.

FARADAY HOUSE OLD STUDENTS' ASSOCIATION.—Mr. C. P. Sparks, chief engineer of the County of London Electric Supply Co., Ltd., has been elected President of this Association, for 1907, vice Mr. S. F. Beevor resigned.

ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.—The first annual conference will be held in Leeds on Thursday, Friday and Saturday, May 23rd, 24th and 25th, 1907. There will be an address of welcome to the Association by Ald. F. Kinder, J.P., Chairman of the Leeds Education Committee, and an address by the President, Mr. V. A. Mundella, M.A., B.Sc., followed by a visit to the University meetings for the dispatch of business and reading papers. The latter include:—

"Notes of an Educational Visit to the United States of America," by H. Ade. Clark, Wh. Sc., A.R.C.Sc. (Vice-President).

"The Preliminary Training of Technical Students," by Barker North, A.R.C.Sc., F.C.S. (Chairman W.Y. Branch).

"Syllabuses and Examinations as Applied to Building Subjects," by J. Fitzgerald (Chairman, London Building Section), and E. L. Bates (London Building Section).

There will also be visits to works, &c., the annual dinner, and an excursion to Bolton Abbey and Woods. Ladies are invited, and special arrangements have been made for hotel accommodation and reduced railway fares. Hon. Sec. of the Conference Committee, Mr. James G. Edwards, 21, Sefton Avenue, Beeston Hill, Leeds.

INSTITUTION OF CIVIL ENGINEERS.—Our readers are reminded that the fourth Engineering Conference will be held on June 19th, 20th and 21st, commencing each day at 10 a.m., and the annual conversazione on the evening of June 20th at the Royal Albert Hall. We gave some particulars of the Electrical Section in our issue of March 15th.

The Brennan Gyroscopic Train.—A great sensation has been created in the lay Press, and a modified echo of it appears to have found its way into the technical Press, as the result of Mr. Louis Brennan's invention of a "gyroscopic train." As a "scientific toy," to quote Sir William Preece's historic phrase in another connection, the Brennan mono-rail car is highly interesting; but that is probably the extent of its usefulness. Be it remembered that if from any cause whatever the gyroscopes stop, the car, which, we are told, may be travelling at 100 miles an hour, will come literally under the sway of gravitation; the inventor provides against this eventuality by means of what appear to be a pair of stilts, which automatically protrude themselves from the sides of the car. Should these stilts fortunately escape collision with chance obstructions, and meet the ground at the precise instant when the car comes to rest on a level, all may be well, and we shall regard with admiration, not unmixed with amusement, the spectacle of a railway car precariously straddling on a tight-rope with the aid of a pair of props.

If a rail near the ground takes the place of the tight-rope, the passengers will have the consolation that they will not have so far to fall.

We have a dim recollection that an obscure individual of the name of Jenkin invented a system of rope railways, and that two other gentlemen, named respectively Ayrton and Perry, did a good deal in the same direction; curiously enough, these inventors were so blind to the sublime possibilities of tight-ropes and gyroscopes, though one of them was an authority on spinning-tops, as to hang their "skips" on trolleys, with the centre of gravity below the rope. Naturally, a system such as this, practically devoid of the element of risk so highly prized by the virile British nation, failed to attract much attention, though a German named Langer, misled by the example of his predecessors, designed a railway 8 miles long on a similar principle—and it is still running.

The fact that the War Office and the Indian Government have supplied Mr. Brennan with funds to continue his interesting researches, is significant of the true value of the invention. It will be remembered that Mr. Brennan received £110,000 for his torpedo, which, we believe, is *not* used by the British Navy. The Board of Trade, however, is a department of a very different stamp; and we think we see it laying down the necessary regulations, subject to which the Brennan mono-railway will be permitted to carry passengers. The gyroscope has many exceedingly valuable applications, as for instance in the Whitehead torpedo; but we have grave doubts as to its utility in the present connection.

The Electro-Chemical Industry in Austria-Hungary. In the course of a recent article upon the growth of the chemical industry in Austria-Hungary, printed in the *Chemiker Zeitung*, Dr. A. Schwoner, of Vienna, gives some interesting particulars of developments in an electro-chemical direction. Processes for the direct preparation of nitric acid from atmospheric nitrogen, in which the Badische Anilin und Soda Fabrik is largely concerned, have not yet been taken up in that country; but the manufacture of calcium cyanamide has already grown to considerable dimensions. The Italian Società di Prodotti Azotati has erected two factories in Austria for making cyanamide, one close to the Almissa Waterfall in Dalmatia, the other near Fiume, the processes employed being those covered by the patents held by the Cyanidgesellschaft; while the Austrian "Verein für Chemische und Metallurgische Produktion" is also about to manufacture calcium cyanamide at Aussig according to the processes patented by the "Kalkstickstoffgesellschaft" of Westeregeln. In all parts of Austria-Hungary where large water-powers exist and where labour conditions are favourable, caustic soda, calcium carbide, ferro-silicon, &c., are being made, *e.g.*, at Jaice near Meran in Bosnia, at Deutsch-Matrei, Landeck, Innsbruck, and at the Kerka Falls, in Dalmatia. A combination of German financiers having already control of four million kronen, is in treaty with the Hungarian Minister of Commerce with reference to the erection of a new factory where ammonia soda is to made from sea salt; and the most probable situation of the works is thought to be Fiume. Another factory for the utilisation of sea salt, a subject in which special interest is being displayed at the present time, is to be erected by the Verein für Chemische und Metallurgische Produktion, at Monfalcone, near Trieste. This last company recently celebrated the 50th year of its existence, and during the past four years has paid dividends at the rates of 12, 10, 8, and 14 per cent.

Electric Wiring in West Ham.—The *Electrical Bulletin* for April, issued by the enterprising Electricity Department of the West Ham Corporation, contains under the head of "Useful Information" what purport to be the approximate costs of complete installations. For example, a six-roomed house, it is stated, can be wired, complete with fittings and pendants for nine lights, at a cost of £6 to £6 10s.; this estimate covers a 3-light fitting in one of the rooms. Similarly, an 8-roomed house with 13 lights, including a 3-light fitting and a rise and fall 2-light pendant, can be done for £9 to £9 10s. The lower price corresponds to 13s. or 14s. per light, and may be taken as the irreducible minimum, with passably good workmanship and material; but what sort of fittings can be included in the estimates? It would be interesting to have the views of contractors on the subject of these estimates; they would probably be the reverse of complimentary. At the least, the department might have excluded fittings from the price quoted, or named a much higher figure for the second price. There is nothing to be gained by misleading prospective consumers as to the cost of their installations.

REVIEWS.

Conduction of Electricity through Gases. By J. J. Thomson, D.Sc., L.L.D., Ph.D., F.R.S. (Second edition). Cambridge: University Press. 1906. Price 16s.

Many additions have been made to this work and a considerable portion rewritten, considerably increasing the size of the book.

In Chapter III, on the mathematical theory, Mie's solutions for the case when the current is only a small fraction of the saturation current, and when the current is nearly saturated, are given.

Chapter XII now deals with radio-active substances, and the next chapter deals with the power of the elements in general to emit ionising radiation.

The chapter on spark discharge has also been almost doubled in length.

The first edition of this work is already so well known to students of physics, that it only remains for the writer to say that the second edition will take the place of its predecessor as the standard work on the subject dealt with.

The Physical Laboratories of the University of Manchester. London and Manchester: Sherratt & Hughes. Price 5s. net.

This is a volume intended to commemorate the twenty-fifth anniversary of Dr. Schuster's election to a professorship at Owens College. It is divided into three sections, the second of which deals intimately with Dr. Schuster's life and work. There are 15 pages filled with only the headings of his publications and addresses since 1881. A biography is also given, which sets forth the leading incidents of his busy life, and a portrait of Dr. Schuster forms the frontispiece.

The first section of the book is devoted to descriptions of the laboratories. This naturally begins with an account of the students' laboratories and their regulations. But what may be of greater interest to many are the descriptions of special apparatus, such as the large concave Rowland grating. Here some insight is given into the difficulties of effective mounting of the grating and camera. The ultimate design adopted for overcoming these difficulties is of interest to those concerned in any way with the construction or use of optical apparatus. Further spectroscopic appliances and supplementary apparatus for spectroscopic research are enumerated, and the list indicates a very complete equipment for work of this nature. An account of work on meteorological research and atmospheric electricity, directed by Mr. G. C. Simpson, follows next; after which, mention is made of the equipment with which the laboratories are provided for investigations of radio-activity, thermal conductivities, soap film thicknesses, low temperature, and properties of matter under high pressures. In considering all the various departments of the physical laboratories, it is obvious that a large amount of energy and scientific skill has been expended upon their design and organisation by Dr. Schuster and his colleagues.

The final section of the book contains records of the students and demonstrators, who have in the course of their work come in contact with Dr. Schuster, either as his pupils or his assistants. The gathering together of the requisite information for this section must have involved considerable labour: and such a mistake as the description of one gentleman as "bracketed 12th—16th Wrangler" can, perhaps, on this account be overlooked. The book ends with another list, this time of well-known physicists and engineers connected in some way or other with Owens College.

As a whole, the book contains much interesting matter, though possibly this is not put before the reader in the most attractive way. It should be of especial interest to past, present and coming students of the Physical Laboratories of the University of Manchester.—J. de G. H.

The Classification of Alternate-Current Motors. By V. A. Fynn. London: The *Electrician* Printing and Publishing Co. Price 3s. net.

This little book deals with a subject of considerable importance at the present time, because, as the author points out, a great deal of confusion has arisen through the rapidity with which descriptions and patents of so-called new single-phase motors have followed one another.

The method of treatment adopted by the author, however, is hardly calculated to improve matters. Without being able to claim anything like completeness for his classification, he yet deals with some 37 different types, whilst, in spite of the recent activity in this direction, probably only some five or six types have stood the test of actual construction. Under these circumstances any elaborate classification seems at least premature, and certainly less likely to be of practical service than a more detailed and critical classification of the few types at present in use, or, from their theoretical qualities, likely to come into use.

With the object of avoiding controversial matter, the author has omitted all mention of inventor's names and all references to the literature of the subject, so that it is in some cases difficult to recognise well-known types under their new names. When the special meaning attached to the terms used is grasped, however, the classification will be found to be systematic, and the occasional comparisons between the different motors are clear and useful. The following cases will serve as examples of the nomenclature adopted throughout:—The term "series motor" is no longer allowed to mean one with armature and field windings connected in series, but is used for any motor "in which the field excitation varies in some proportion with the armature current, and the speed of which therefore varies with varying load." The term "repulsion motor" is entirely set aside, and is replaced by the imposing title: "Self-excited, partly-compensated single-phase series induction motor." This is a heavy sacrifice to make on the score of classification, especially as the name "simple repulsion motor" has come to be quite generally confined to a commutator motor having a single stator winding, and with its brush axis inclined to the field axis.

On the whole, we fear that the subject is not treated in a way likely to bring the author's suggestions into common use.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—An error occurred in our reference last week to Mr. J. R. P. Lunn. He is engineer and manager of the Darlington Electricity and Light Railways Department, not Stockton-on-Tees. The salary of his office (at present £350 per annum) is to be increased by £100 per annum—£50 this year and £50 next year.

Mr. R. Withycombe, who until recently held the position of chief assistant engineer in the West Ham Corporation Tramways Department, has been appointed engineer and manager to the Zanzibar Lighting, Railway and Telephone Co. Mr. Withycombe left London for his destination on Thursday last week.

Mr. W. Y. Anderson, of the Lancashire Electric Power Co., has been appointed (out of 243 applicants) junior assistant in the Birmingham Corporation Supply business development department.

At a meeting of the Southport Electricity Committee on Thursday last week, the resignation was received of Mr. R. S. DOWNE, the borough electrical engineer, who has held the post six years. He has been appointed general manager of an industrial concern. The salary at Southport is £500 per annum, with the privilege of having two premium pupils.

Mr. C. J. JEWELL has resigned his position with Messrs. W. T. Glover & Co. to take up the post of resident engineer to the Wakefield and District Light Railway Co.

General.—The City and Guilds of London Institute has appointed Mr. W. NOBLE, of the engineer-in-chief's department, General Post Office, co-examiner in the subjects of Telegraphy and Telephony for the ensuing five years. The present joint examiner is Mr. A. J. Stubbs, assistant engineer-in-chief to the Post Office.

Mr. A. S. E. ACKERMANN is leaving on Saturday, 18th inst., for a tour in Austria and Dalmatia, and expects to return to Westminster on June 11th. Though it is primarily a pleasure trip, Mr. Ackermann has been instructed by the *Times* to report on the engineering aspect of the tour.

Councillors NICOL and WILLOCK, with Mr. W. W. LACKIE, chief engineer, are to represent the Glasgow Corporation at the annual convention of the Incorporated Municipal Electrical Association, at Sheffield, on June 24th.

Mr. A. F. HARRIS, of Messrs. Nalder Bros. & Thompson, Ltd., was yesterday married at St. Paul's, West Brixton, to Violet Crede, daughter of I. W. Palmer, Esq. Congratulations!

Obituary.—The death occurred at Lucknow on April 11th, from enteric, of Mr. T. E. A. GLEADOWE, electrical engineer for the Oudh and Rohilkhand Railway.

The death has recently occurred of Alderman W. H. BROWN, chairman of the Newport Electricity and Tramways Committee. He was one of the strongest supporters of the electrical undertaking.

We deeply regret having to place on record the death of Mr. W. J. JOHNSTON, of New York. Mr. Johnston was born in Ireland in 1851, and after some years' service as a telegraph operator in the States, he threw his energies into the building up of a paper, the *Operator*, which ran as a semi-monthly until 1883, when it became the *Operator and Electrical World;* this title was abridged in 1883, and for years the paper was known as the *Electrical World*, having a very successful record, and combining with the *Electrical Engineer* of New York. Mr. Johnston disposed of the paper in 1899 to the McGraw Publishing Co., its present owners. Since then he has travelled abroad a good deal in the interests of engineering and trade publications which he founded, or with which he became connected. Mr. Johnston, in his *Electrical World* days, was a frequent visitor to this country and a caller at the offices of the ELECTRICAL REVIEW. His death occurred on April 28th at the comparatively early age of 56. Cerebral hæmorrhage was the cause.

NEW COMPANIES REGISTERED.

John Stirk & Sons, Ltd. (93,246).—This company was registered on May 4th, with a capital of £20,000 in £1 shares, to acquire (*a*) the freehold works, lands and premises belonging to John Stirk & Sons, at Turney Street, Ovenden Road, Halifax, and the business carried on there, (*b*) the freehold house, No. 6, Turney Street, Halifax, and (*c*) the freehold works at Exmoor Street, Halifax, occupied by the Northern Engineering Co (1900), Ltd., with the plot of land adjoining, and the business carried on there, to adopt an agreement with G. Stirk, E. Stirk, R. Stirk and J. G. Stirk, and to carry on the business of toolmakers, ironfounders, mechanical and electrical engineers, manufacturers of dynamos, motors, motor-carriages and vehicles, &c. The first subscribers (each with one share) are:—G. Stirk, 23, Lentil Field Street, Halifax, engineers' toolmaker; E. Stirk, 36, Elmfield Terrace, Halifax, engineers' toolmaker; R. Stirk, 6, Turney Street, Halifax, engineers' toolmaker; J. G. Stirk, 25, Lentil Field Street, Halifax, engineers' toolmaker; Miss M. A. Stirk, 25, Lentil Field Street, Halifax; Mrs. M. Stirk, 23, Lentil Field Street, Halifax; Mrs. H. E. Stirk, 36, Elmfield Terrace, Halifax; and Mrs. J. Stirk, 6, Turney Street, Ovenden Road, Halifax. No initial public issue. The number of directors is not to be less than two or more than five; the first are G. Stirk, E. Stirk, R. Stirk and J. G. Stirk; qualification, £100; remuneration as fixed by the company. Registered office, 7, Turney Street, Ovenden Road, Halifax.

Fors Accumulator Co., Ltd. (93,192).—This company was registered on May 1st, with a capital of £10,000 in £1 shares, to acquire Patent No. 17,238 of 1905, for improvements in electrodes for secondary batteries and the benefit of applications for patents for other inventions relating to improvements in batteries and certain trade marks relating thereto, to adopt an agreement with H. F. Joel, A.M.I.C.E., and to carry on the business of electrical engineers, manufacturers of and dealers in accumulators, storage batteries and electrical appliances of all kinds, &c. The first subscribers (each with one share) are:—L. T. Connor, 23, Kirkley Road, Merton, secretary; H. T. Nicholls, 46, Beaconsfield Road, New Southgate, N., cashier: L. Metcalfe, 91, Palmerston Road, Walthamstow, clerk; H. C. Crouch, 6, Oakwood Gardens, Seven Kings, journalist; I. M. Stretch, 136, Wellesley Road, Ilford, merchant; A. T. Hargreaves, 174, Wydale Road, Nunhead, S.E., managing clerk; and G. W. Watson, 14, Gerda Road, New Eltham, Kent, managing clerk. No initial public issue. Table "A" mainly applies. Registered office, 110-11, Strand, W.C.

F. F., Ltd. (93,211).—This company was registered on May 2nd, with a capital of £500 in 495 "A" or preference shares of £1 each and 100 "B" or ordinary shares of 1s. each, to acquire lands, buildings, concessions, orders for electric lighting, tramways and light railways, and real or personal property of any kind, and to carry on the business of financiers, promoters, capitalists, &c. The first subscribers (each with one "A" share) are:—C. M. Sofiano, 17, Burleigh Mansions, Charing Cross Road, W.C., theatrical manager; J. B. Howard, 3, Bedford Street, Strand, W.C., theatrical manager; W. B. Palmer, 9, Old Square, Lincoln's Inn, W.C., solicitor; H. G. Lee, 11, Effingham Road, Lee, S.E., insurance manager; W. E. Moser, 27, Chancery Lane, W.C., journalist; J. G. Skiffington, 52, New Court, Lambeth, S.E., butcher; and H. W. Blazey, 3, M... Road, Catford, S.E., clerk. No initial public issue. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, one share; remuneration as fixed by the company. Registered office, 9, Catherine Court, Tower Hill, E.C.

International Works Construction Co., Ltd. (93,176).—This company was registered on April 30th, with a capital of £200,000 in £1 shares, to construct, improve, maintain, develop, work and control any roads, ways, tramways, branches, sidings, canals, bridges, reservoirs, water courses, wharves, factories, warehouses, electric works, shops, stores and other works and conveniencies, to acquire running powers, rights or easements over any railway, tramway, canal, line of electrical wire or similar means of communication, to carry on the business of an electric light and power company, &c. The first subscribers (each with one share) are:—J. M. Sing, Stivelooms, Heswall, Cheshire, gentleman; Lord Drogheda, Moore Abbey, Monasterevan, Co. Kildare; G. S. Fort, 19, Portsea Place, Connaught Square, W., gentleman; A. Trendall, C.M.G., 6, Prince Edward's Mansions, Palace Court, W., and Inner Temple; W. E. Pease, Mowden, Darlington, gentleman; T. Bell, 23, Windsor Terrace, Newcastle-on-Tyne, J.P.; and G. E. Musgrove, 86, King William Street, E.C., private secretary. Minimum cash subscription 20 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than seven: the subscribers are to appoint the first. Qualification, £250; remuneration £250 each per annum (£250 extra for the chairman).

Anglo-South American Public Works Co., Ltd. (93,296).—This company was registered on May 9th, with a capital of £10,010 in 10,000 ordinary shares of £1 each and 200 founders' shares of 1s. each, to acquire the connection in South America of Kirby, Son & Brown, of 1, Victoria Street, S.W., and G. J. H. Hooghwinkel, of Dacre House, Westminster, to adopt an agreement with W. C. Kirby, W. A. Brown and G. J. H. Hooghwinkel, to acquire any contracts, concessions, decrees, rights and privileges relating to the construction, equipment and management of railways, tramways, docks, harbours, wharves, canals and other public works and conveniences of all kinds, and to carry on the business of financiers, company promoters, bankers, underwriters, concessionaires, agents, &c. The first subscribers (each with one share) are:—W. A. Brown, 1, Victoria Street, S.W., civil engineer; F. J. Commin, 1, Victoria Street, S.W., surveyor; J. H. Baker, 79, Tressillian Road, Brockley, secretary; F. W. Commin, 96, Upper Tulse Hill, Brixton, architect; F. L. Winsor, 43, Blythe Hill, Catford, S.E., engineer; W. J. Patten, 11, Kenwyn Road, Wimbledon, S.W., engineer; W. P. Dean, 10, Kenwyn Road, Wimbledon, S.W., accountant. No initial public issue. The number of directors is not to be less than two or more than seven; the first are W. G. Brown and G. J. H. Hooghwinkel. Kirby, Son & Brown may appoint one of the future directors, pursuant to said agreement; qualification (except first directors), two shares; remuneration as fixed by the company.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

W. T. Henley's Telegraph Works Co., Ltd. (13,795).—This company's annual return was filed on March 22nd, when the entire capital of £400,000 in 40,000 preference and 40,000 ordinary shares of £5 each had been taken up. £5 per share has been called up on 39,880 preference and 32,616 ordinary, resulting in the receipt of £362,480. £37,520 is considered as paid on 120 preference and 7,384 ordinary. Mortgages and charges: £150,000.

Britannia Electric Lamp Works (1905), Ltd. (86,967).—This company's annual return was filed on April 22nd, when nine preference and 15,000 ordinary shares had been taken up out of a nominal capital of £25,000 in 10,000 preference and 15,000 ordinary shares of £1 each. £1 per share has been called up on nine preference and 250 ordinary, and 12s. 6d. per share on 1,000 ordinary shares, and £812 10s. has been received, leaving £71 10s. in arrear. Mortgages and charges: £200.

Chelsea Electricity Supply Co., Ltd. (20,468).—This company's annual return was filed on April 12th, when 49,436 ordinary and 6,000 preference shares had been taken up out of a nominal capital of £400,000 in 14,000 ordinary and 6,000 preference shares of £5 each. £5 per share has been called up on 37,770 ordinary and 6,000 preference, and £218,850 has been received. £58,330 is considered as paid on 11,666 ordinary shares. Mortgages and charges: £175,000 debenture stock.

County of Durham Electrical Power Distribution Co., Ltd. (61,591).—This company's annual return was filed on April 27th, when the entire capital of £500,000 in 50,000 preference and 50,000 ordinary shares of £5 each had been taken up. £5 per share has been called up and £473,958 has been received, leaving £26,042 (being balance of final call due April 22nd) unpaid. Mortgages and charges: Nil.

Tyneside Electrical Development Co., Ltd. (90,884).—This company's annual return was filed on March 2nd, when the entire capital of £100,000 in 100 shares of £1,000 each had been taken up; £100 per share has been called up, resulting in the receipt of £10,000. Mortgages and charges: Nil.

South London Electric Supply Corporation, Ltd. (50,392).—This company's annual return was filed on April 26th, when the entire capital of £325,000 in 65,000 shares of £5 each had been taken up and paid for in full. Mortgages and charges: Nil.

Cycle Electric Lamp Co., Ltd. (50,591).—This company's annnual return, made up May 1st, 1906, was filed on April 12th, 1907. The entire capital of £30,000 in £10 shares has been taken up; £10 per share has been called up on 275, and £2,350 has been received, leaving £400 in arrears; £27,250 is considered as paid on 2,725 shares. Mortgages and charges: Nil.

Dynamotor, Ltd. (75,563).—This company's annual return was filed on March 25th, when 5,530 shares had been taken up out of a nominal capital of £6,000 in £1 shares. £1 per share has been called up on 530, and £524 has been received, leaving £6 in arrears. 5,000 shares are considered as fully paid. Mortgages and charges: Nil.

Electrolytic Alkali Co., Ltd. (Middlewich).—Issue on April 17th, of £2,700 4½ per cent. debentures, part of series created July 9th, 1904, to secure £50,000, charged on the company's undertaking and property, including uncalled capital. Trustees: Liverpool Mortgage Insurance Co., Ltd. Previously issued of same series: £28,250.

South London Electric Supply Corporation, Ltd. (50,392).—A memorandum of satisfaction in full of 500 debenture bonds dated January 28th, 1904, securing £50,000, has been filed.

Chiswick Electricity Supply Corporation, Ltd. (38,854).—This company's annual return was filed on April 9th, when 60,900 shares had been taken up and paid for in full out of a nominal capital of £100,000 in 99,900 ordinary and 100 founders' shares of £1 each. Mortgages and charges: £50,000.

Scarborough Electric Supply Co., Ltd. (37,569).—This company's annual return was filed on March 11th, when the entire capital of £100,000 in £10 shares had been taken up and paid for in full. Mortgages and charges: Nil.

Northallerton Electric Light and Power, Ltd. (59,301).—This company's annual return was filed on March 20th, when 1,151 preference and 4,561 ordinary shares had been taken up out of a nominal capital of £6,500 in 2,900 preference shares of £1 each and 12,000 ordinary shares of 6s. each £2,519 6s. has been received. Mortgages and charges: £5,140.

British L. M. Ericsson Manufacturing Co., Ltd. (79,061).—This company's annual return was filed on April 22nd, when 100,010 shares had been taken out of a nominal capital of £300,000 in £1 shares. £1 per share has been called up on 50,010 and £70,010 (query: 8s. per share called up in cash on 50,000 ?) has been received. £30,000 (12s. per share) is considered as paid on 50,000. Mortgages and charges: Nil.

National Telephone Co., Ltd. (15,066).—This company's annual return was filed on April 3rd, when the entire capital of £6,500,000 in 15,000 first and 15,000 second preference shares of £5 each, 250,000 third preference and 100,000 new shares of £5 each, £2,225,000 preferred stock, had been taken up. £4,174,760 has been received in cash and £2,325,240 is considered as paid. Mortgages and charges: £3,716,593. Although the nominal capital is given in the return as £6,500,000, it was actually increased to £7,500,000 a few days before the date to which the return was made up, and the new capital (200,000 shares of £5 each) was all issued on March 27th, subject to payment in cash, 10s. per share being called up.

Yorkshire (West Riding) Electric Railways Co., Ltd. (84,167).—This company's annual return was filed on March 23rd, when 46,261 preference and 40,000 ordinary shares had been taken up out of a nominal capital of £600,000, in 70,000 preference and 50,000 ordinary shares of £5 each. £431,305 is considered as paid. Mortgages and charges: £275,000 4½ per cent. debenture stock.

Uxbridge and District Electric Supply Co., Ltd. (62,706).—Issue on May 1st of £1,000 6 per cent. second debentures, part of series created July 10th, 1906, to secure £15,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £13,000.

Electrical Power Storage Co., Ltd. (London), (30,313).—Issue on April 30th of £7,900 5 per cent. debentures, part of series created February 14th, 1907, to secure £30,000, charged on the company's undertaking and property, including uncalled capital. No trustees. No previous issue of same series.

Cryselco, Ltd. (58,218).—Issue on May 1st of £300 4½ per cent. debentures, part of series created June 26th, 1905, to secure £10,000, charged on the company's undertaking and property, present and future, including uncalled capital, and the Kempston Works, Kempston, Bedfordshire. Trustees: A. Baker, Billiter House, E.C.; and H. S. Deacon, Kempston, Bedfordshire. Previously issued of some series, £8,200.

CITY NOTES.

Craigpark Electric Cable Co., Ltd.

The fourth annual general meeting was held in Glasgow on 8th inst. Mr. James T. Tullis, who presided, stated that last year they suggested that the prospects of the company were better and they now found themselves paying 6 per cent. on the ordinary stock, compared with 4 per cent. for the previous year. They had written off £700 for preliminary expenses, and £1,000 for depreciation, which pointed to a fairly substantial success. What the directors were anxious to do was to establish a thoroughly sound business, and by paying 6 per cent.—they aimed at paying 6 per cent. for some time—and writing down the value of the buildings for depreciation, the business might become a very sound one. So far as the golf ball section was concerned, the company was making very steady progress. They were expending a large sum of money on this section of the business, which was being taken out of the revenue. The electric wire section was also in a most healthy condition. They had been negotiating with the big combine of electric wire makers, thinking that they would benefit by entering the combination, but it was ultimately decided that they should stand by themselves and endeavour to produce an article which would, in spite of the competition of this combination, succeed in establishing itself. He thought the company had a very bright future before it. It meant work, but the directors had the interests of the business very much at heart. Now that the troubles were gradually passing away, he looked forward to a very prosperous future.

Mr. Dick seconded, and the report was adopted.

The Eastern Telegraph Co.

The meeting of this company was held on Tuesday at Electra House, Sir J. Wolfe Barry presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, May 10th, page 775), said that in the aggregate their receipts showed an improvement of about £9,000 compared with the corresponding quarter of 1905. At the last meeting he referred to the decrease in the message receipts on the correspondence exchanged with India, China and Japan, Egypt and South Africa. The receipts from traffic with China and Japan still showed a falling off as compared with the corresponding period of 1905. This was owing to the general decrease of traffic coming after the inflation caused by the Russo-Japanese war, but there were signs that this last-named traffic was on the road to recovery. To a large extent the South African traffic had always depended on mining business, and he was afraid that, judging from the present state of that industry, it would be some time before they were likely to regain their former amount of traffic. He was in hopes, however, that in course of time the general commercial business of South Africa would gradually increase so as to make up what they had lost through the falling off in the Stock Exchange business of the mines. Their receipts from correspondence exchanged with India, South America and Egypt, showed substantial increases, but against this they had had, in respect of Egypt, to carry 25 per cent. more work for the same money, and the same remark, to a less extent, was true with regard to India. With regard to the expenditure, it was somewhat difficult to draw any comparisons, but the accounts for that period under review contained no variations of an important character. The working expenses had, however, increased during the quarter for the reasons stated at the last meeting—viz., in consequence of the augmentation of the staff abroad, rendered necessary owing to the larger volume of work to be handled consequent upon the important reductions which had from time to time been made in the tariff, and to the automatic increases in the salaries, but apart from the increase under the heading of salaries and wages, the expenses under this abstract had remained normal during the quarter. The laying of the new cable between Porthcurnow-Fayal and St. Vincent, to which he had before referred, had occasioned an increase in their contributions towards the expenses of other companies' stations where their cables were joined up. As a set-off against these items of increased expenditure, the expenses in respect of the maintenance of their cables were a good deal below the average, the reason being that the amounts received for the chartering of their repairing steamers by other companies was larger than usual. The net result of working for the nine months to December 31st, 1906, was that they had an available balance of £284,752, and, after making suitable provision for the reserve funds, they were able to propose the payment of a final dividend of 1¼ per cent. and a bonus of 2 per cent., making, with previous distributions, a total payment of 5¾ per cent. for the nine months. This was equivalent to their customary distribution at the rate of 7 per cent. per annum, including dividend and bonus. As the result of protracted negotiations with the Portuguese Government, the concession which the company held, conveying the sole right for landing cables between Great Britain and Portugal and between Portugal and Gibraltar and Malta, had been extended for a further term of 15 years.

Sir John Denison-Pender seconded the motion, and it was carried without discussion.

The West India and Panama Telegraph Co., Ltd.

The meeting held on Wednesday at Winchester House, was presided over by Mr. W. B. Kingsford, who, in proposing the adoption of the report (see Electrical Review, May 10th, p. 774), said that the half-year under review had yielded the largest receipt for any December half-year since the year 1893, excluding, of course, the special half-year of December, 1898, when they derived an abnormal receipt from the Spanish-American war traffic. The traffic receipts had increased by £5,460. Approximately 70 per cent. of this increase was yielded by the foreign group of stations, the British section accounting for the remainder. The expenses were £21,612, against £23,231, a decrease of £1,619. Apart from a few minor savings in certain other items, this reduction was attributable to their ship having been engaged in cable repairing work for only 78 days, as compared with 159 days in the same period of last year. Of course, their expenditure under this head was subject to considerable fluctuation, and during the half-year they had been exceedingly fortunate in regard to repairs. Considering the very extensive area over which their cables operated, the earnings of the company had always been, and still were, very small. It was, therefore, encouraging to be able to report that the present balance of revenue £12,591, was the largest they had ever had in any half-year ending either in June or December, during the last eight years, even if they excluded from it the £1,000 transferred from income-tax account. To that balance was added £1,547 interest on investments, and £312 brought forward, making a total to be dealt with of £14,451. The directors accordingly recommended the payment of 8s. per share on the first preference shares, being 2s. balance of arrears and 6s. dividend in full for the six months to December 31st last, together amounting to £13,825, carrying forward a balance of £626. The board had satisfaction in thus being able to recommend a dividend which finally cleared the first preference shares of the arrears of dividend which began to accrue 6½ years ago. Cable communication had been restored between Dominica and St. Lucia. Before the eruption of Mont Pelé five years ago, they had two cables in that portion of their system—one from St. Lucia to Martinique and another from Martinique to Dominica. Owing to the destruction of St. Pierre, it was no longer necessary to land at Martinique and they had, therefore, now joined up the two cables in the one, thus putting St. Lucia and Dominica into direct communication; 54 knots of cable had been expended in carrying out the work, and the cost would be charged in the next accounts. The disastrous earthquake at Jamaica was fresh in all their minds. As regarded their own share in the disaster, he regretted to report that their office in Kingston was completely wrecked, the walls falling outwards and carrying with them the clerks who were on duty at the time. That they escaped with their lives, and without even serious injury, was miraculous. One of them was buried under the ruins, but when rescued by his companions, was found to be very little hurt. In addition to the destruction of their Kingston office several miles of the land lines connecting up with their cables were destroyed. Their clerk-in-charge, Mr. McLeod, at great personal risk, succeeded in digging one instrument out of the ruins, and so established a temporary office in a small hut at Bull Bay. Telegraphic communication with the outside world was at once soon reopened, thus enabling the Government and the public to transmit through their route, which was the only one available for several weeks, full tidings of the terrible disaster, and all the important diplomatic and other events which followed it. Their staff stuck to their work in the most praiseworthy manner under extremely trying

conditions, being for several days without proper food, and sleeping at night in holes dug in the seashore. Their homes were partially wrecked, and their furniture and other effects destroyed. Their total loss was estimated at £346, which they were asking the shareholders to-day to sanction their paying. Amongst the numerous visitors who happened to be at Kingston at the time of the disaster was Mr. Hamar Greenwood, M.P., who had been good enough in the Press and elsewhere to make mention of the admirable way in which the staff of their company stuck to their work, and he (the Chairman) had since received a letter from Mr. Greenwood speaking in highly complimentary terms of Mr. McLeod and the staff there.

Mr. HENRY HOLMES reconded the motion, and the report was adopted.

Subsequently a resolution was passed authorising the board to expend £346 to cover the loss sustained by the staff.

The Chiswick Electricity Supply Corporation, Ltd.

THE annual ordinary general meeting was held on Wednesday at the offices, 14, Ironmonger Lane, Cheapside, Mr. W. B. Esson presiding.

The report and accounts, which were adopted, stated that the progress made by the corporation's undertakings continues to be satisfactory. During the year £6,112 has been expended on capital account for machinery, mains, free wiring, &c. The share and loan capital stand the same as last year. The total number of lamps, motors, &c., fed from the Corporation's mains at Chiswick and Aberystwyth is equivalent to 60,351 lamps of 8-C.P. The following table shows the progress made during the last three years:—

	Equivalent of 8-C.P. lamps.	Revenue.	Profits. (Distributed in interest and dividends).
1904	41,560	£10,392	£4,186
1905	49,857	£12,191	£5,393
1906	60,351	£13,413	£6,087

The number of consumers at the end of the year was 1,378, and extensions are now in progress both at Chiswick, and Aberystwyth to meet the increasing demand for current. The maximum power sent through the mains in 1906 was—for Chiswick 874 E.H.P. on December 21st, and for Aberystwyth, 280 E.H.P. on August 18th. The profit made by the Corporation for the year amounted to £6,127. Out of this sum interest on debentures and temporary loans amounting to £2,439 has been paid, leaving a balance of £3,687 to the credit of net revenue account. This the directors propose to apply to the payment of a dividend on the ordinary shares of 6 per cent. for the year, carrying a small amount forward.

The Edison General Electrical Co., of Milan.—Senator Colombo presided at the recent general meeting, held in the hall of the Commercial Bank of Milan. The present steam capacity available is 19,000 H.P. In 1908 this will have to be increased to 40,000 H.P. It is hoped, however, that 26,000 H.P. will be generated at the hydraulic works on the Adda, where there is a fall available of 40 metres. Several new electric tramlines are to be laid down as a consequence of the agreement entered into with the Government, whereby the company provided additional rolling stock to cope with the heavy traffic during the period of the recent Exhibition. The mains network now extends to 433 km., distributing to 210 sub-stations. The number of motors supplied is 5,790, having a total power of 10,962. The balance available for dividend is 3,145,555 lire, enabling a payment of 30 lire to be made on each of the original 50,000 shares, and 15 lire on each of the 10,000 new shares, the balance being divided between the reserve fund, depreciation and carry forward.

Swansea Improvements and Tramways Co., Ltd.—This company held its meeting on 7th inst., Mr. Tegetmeier presiding. The directors' report, which showed an increase of £1,897 in gross receipts (£25,075) and of £798 in expenses (£19,227), and recommended a 2½ per cent. dividend on the ordinary shares, carrying forward £1,999, was adopted. The average receipts per passenger were 1·24d., against 1·27d. The expenses were ·72d. against ·78d. The route mileage is 12·43. The passengers carried were 4,702,339, against 4,266,952. £3,000 was placed to depreciation for the year, bringing up the reserve to £20,858. The ordinary dividend of 2½ per cent. was only earned by a rigid economy and efficient management, and it was stated that they would have to seriously consider the question of raising the fares.

Stock Exchange Notices.—The Committee has appointed a special settling day as under:—

Thursday, May 23rd.—Victoria Falls Power Co., Ltd.—625,000 preference shares of £1 each, fully and partly (10s.) paid, Nos. 1 to 625,000.

And ordered the undermentioned to be quoted in the Official List:—

Edmundson's Electricity Corporation, Ltd.—Further issue of £83,000 4½ per cent. first mortgage debenture stock.

Hove Electric Lighting Co., Ltd.—Further issue of 2,000 ordinary shares of £5 each, fully paid, Nos. 13,001 to 15,000.

Submarine Cables Trust.—The annual meeting was held at Electra House on 14th inst., the Marquess of Tweeddale presiding. The chairman stated that the revenue amounted to £25,278, an increase of £220. Their total investments gave a return of over 8 per cent.

West London and Provincial Electric Supply Co., Ltd.

THE meeting of this company was held on Wednesday at the offices, 14, Ironmonger Lane, Cheapside, Mr. W. B. Esson in the chair.

The directors' report stated that the earnings of the company were dependent on the business done by the Chiswick Electricity Supply Corporation, Ltd., whose shares were owned by the company. During the year the progress made by the undertakings worked by the Corporation had been satisfactory. The Chiswick Electricity Supply Corporation accounts, after paying interest on the debentures and other charges, showed a profit of £3,687 which the directors proposed to apply to the payment of a dividend at the rate of 6 per cent. on the ordinary shares. This will be paid over to the West London Co., whose accounts show a balance at the credit of the profit and loss account in the balance-sheet of £3,143. During the year the scheme for wiping out the arrears of dividend on the cumulative preference shares, by temporarily capitalising the amount of such arrears, was carried through. Accordingly, redeemable funding certificates, carrying interest at the rate of 4½ per cent. per annum, were issued to the persons entitled to such arrears, the certificates amounting in the aggregate to £11,265. This transaction discharged all arrears of preference dividend up to December 31st, 1905. The directors recommended a dividend on the cumulative preference shares at the rate of 6 per cent. per annum for the year, and of interest at the rate of 4½ per cent. per annum on the funding certificates from July 1st to December 31st, 1906, the interest according to the scheme of arrangement being payable from the former date.

In proposing the adoption of the report, the CHAIRMAN said that the chief profit of the company was derived from the Chiswick Electricity Supply Corporation, in which company they held all the shares. The capital put into the company kept on increasing, and it now amounted to £110,900. The number of lamps connected, and the revenue was increasing, and what was most important of all, the profits were larger than before. There was no reason to suppose that the progress the company was making would not be continued in the future—in fact, there was every reason to hope that the business would go on growing. Most of the extension had taken place at Chiswick, where they supplied power as well as light. At Aberstwyth they only supplied light. Last year they expended £6,000 on machinery, mains, free wiring, &c. They kept down the capital expenditure as much as possible, but they were always prepared to put down mains whenever they thought there was a demand for current.

Mr. H. KAHN seconded the motion, and the report was adopted.

Urban Electric Supply Co., Ltd.

THE meeting was held on Thursday, May 9th, at the Westminster Palace Hotel. Mr. FRANCIS E. GRIPPER presided, and in moving the adoption of the report, said that, when he met them a year ago, he explained the difficult conditions under which electric lighting undertakings were working, owing to the severe competition with other methods of illumination—principally, of course, with gas. Those conditions had not materially changed, but they had been able to make very considerable progress in most of their towns. They had connected the equivalent of 54,000 new lamps—an increase of 18 per cent.—and their profits had increased from £28,000 to £33,000, which was also an increase of 18 per cent. All their works were in complete working order, but they could not, of course, add a large number of new consumers without incurring some additional capital expenditure, though the increase in their capital expenditure had been only a little over 4 per cent. The new capital spent during the year had been about £15,000 on additional generating plant and about £25,000 on mains and connections for new consumers. They had included with the accounts a detailed statement showing the profits in each of their undertakings for the past three years, and they would note that although, in most cases a substantial improvement was shown, there were four of the towns which appeared to have gone backwards that year. There had been various causes which accounted for the decrease in profit in those places, the principal one being that, in the previous year, more profit was made on installation work carried out for consumers, and that year such work had either fallen off or resulted in some loss. The directors were going very carefully into that matter, and they hoped to show special improvement in these particular towns in next year's accounts. The net profit for the year, after deducting head office expenses, including directors', auditors' and trustees' fees, amounted to £31,439. From that amount must be deducted debenture interest paid and accrued, amounting to £9,000, leaving a balance of £22,439 available for dividend. The amount required to pay the 5 per cent. guaranteed dividend on both preference and ordinary shares was £32,500, leaving a balance of £10,061, which had been paid by Edmundsons' Electricity Corporation under the terms of their contract. The amount required to pay dividends that year was nearly £8,000 more than in 1905, as this year all the shares ranked for full dividend, whereas in 1905 only a portion of the share capital carried a full year's dividend. This accounted for the larger amount which they had to look to

Messrs. Edmundsons to provide this year. In future their increased earnings should reduce that amount. No further capital had been issued during the course of the year, but an issue of £75,000 debenture stock had just been made, the proceeds of which would go towards paying off the amount standing in the balance-sheet as due to their contractors. As he had explained in previous years, under the contract between the company and Messrs. Edmundsons it was provided that no depreciation was to commence until after 1906. From the beginning of the present year, depreciation would commence under the terms of the contract. By an arrangement with the debenture stockholders, which had been embodied in a supplemental trust deed, it was provided that a cumulative sinking fund of 1 per cent. should be set aside each year, commencing on January 1st, 1909, for the purpose of paying off the debenture stock. That should have the effect of increasing the value of that stock. He regretted to have to report the death quite recently of one of their directors, Mr. William Page. Mr. Page had been a director since the commencement of the company, and had rendered them very valuable services. It was not proposed to fill this vacancy that day, as the board were endeavouring to arrange for the appointment of a representative from the large shareholders. He had also to report with regret the resignation of Mr. Wolfenden. That gentleman, who was one of Edmundsons' representatives on the board, had felt it necessary, owing to ill-health, to relinquish some of his engagements, and the directors had elected Mr. Walter B. Hopkins to fill that vacancy.

Mr. EDMUND CHARRINGTON seconded the motion.

The CHAIRMAN, in answer to various questions, said the price of the current depended upon the amount used. They had a sliding scale in force. The consumer who used the most current per day of course got the current at the cheapest rate. He did not think that their various stations in the different towns could be better controlled than they were at present. The engineers in charge had to send in monthly reports as to the working of their stations, and these reports were of a most detailed character.

The report was then adopted.

Callender's Cable and Construction Co., Ltd.

THE directors' report for the year ended December 31st, 1906, shows a balance at the credit of profit and loss account for the year's working, after providing for income-tax, of £80,773, plus £38,922 brought forward. Out of this interest on debenture stock requires £13,500, dividend on preference shares £10,000, appropriation for depreciation of buildings, plant and machinery £12,867, depreciation of office furniture £356, leaving an available balance of £82,972. It is proposed to pay a dividend on the ordinary shares at the rate of 10 per cent. per annum, clear of income-tax, being 10s. per share (whereof 5s. was paid on November 1st, 1906) = £17,500, to pay a bonus of 5s. per share £8,750, and to carry forward £56,722.

The results thus obtained are considered satisfactory, showing as they do an advance on the excellent figures of 1906. In the early part of the year under review, there was a large demand for cables and other materials manufactured by the company, but, during its concluding months, sales were restricted, owing to the unusually high prices of metals, and especially of copper. The position of copper at the moment is unsatisfactory from the consumer's point of view, the uncertainty as to its future being a greater factor in restraining business and interfering with the extension of electrical enterprises than even the present high prices. As a result, few important contracts for new mains have been entered into during the past six months, and a waiting policy has, in the meantime, been adopted by many of the company's customers. The possibility of legislation affecting electrical supply has also had its effect in postponing new undertakings. The company's business in this country has, therefore, for the present, been chiefly confined to extensions of existing networks. On the other hand, the company's foreign connection has been enlarged and increased. Further contracts of considerable magnitude have been carried out in various parts of India, in Hong Kong, Shanghai, and other places in the Far East. The report continues:—

"Important contracts have been secured in South America and Mexico, our engineers having carried out the laying of our cables in Brazil and in the Argentine. The company's business on the Continent has been vigorously pushed, with satisfactory results, orders having been secured (amongst other places) for the tramways of St. Petersburg and the lighting of Christiania. The company has recently turned its attention to Canada, and arrangements have been made there which have already resulted in satisfactory orders, with every prospect of excellent business being secured in the future. The difficulties which have attended the operations of some of the companies supplying electricity in bulk have caused disappointment to the directors, and have naturally affected this branch of our business. The directors are, however, of opinion that power supply over wide areas will, at no distant date, again require large quantities of underground mains. The securities which the company holds in several of the power undertakings have already been much written down in our books, but before arriving at the profits for last year, a further large sum has been written off to meet possible losses in South Wales and elsewhere, and to provide against further depreciation. The directors consider that they have made ample provision in this respect. The reorganisation of the Anchor Co.'s factory at Leigh, and its business generally, has now been completed. The amount at which the company's interest stands has been amply written down in this balance-sheet out of the sums put aside in past years for that purpose. The working of the Anchor Co. is now satisfactory, and is at a profit, its trade in rubber wires having been considerably extended. The machinery, plant and equipment at the factory at Erith, and on outside contracts, have been maintained in a thoroughly efficient condition, and the cost thereof has, as usual, been charged against the year's profits. A new item appears in this year's balance-sheet, representing the interest of your company in the St. Helen's Cable and Rubber Co., Ltd. As explained at the last general meeting, circumstances arose which rendered it possible for the directors to acquire a share in this business, thereby putting an end to troublesome competition, and assisting the company in other directions. This participation in the St. Helen's business has already proved of considerable benefit to the company. The directors remind the original shareholders that the present balance-sheet covers the twenty-fifth year of the operation of the Callender Cable business."

Calcutta Electric Supply Corporation, Ltd.

THE tenth annual meeting was held on Thursday of last week at Salisbury House, Col. A. J. Filgate presiding.

In moving the adoption of the report (see ELECTRICAL REVIEW, May 3rd, page 734), the CHAIRMAN said that the past year had been a satisfactory one. The capital expenditure during the year amounted to £544,353, an increase of £46,075. They had spent on buildings £5,661, on mains £19,480, and on machinery £12,480. They now had 105 miles of underground mains and 66 of overhead, making a total length of 171 miles. The gross revenue for the year amounted to £89,242, as compared with £72,591 in 1905, an increase of £16,651—or nearly 23 per cent. That increase was in spite of a further reduction in the price of current sold. The revenue expenditure amounted to £39,065, as against £29,349 in the previous year. The number of units sold during the year totalled 4,578,380, an increase of 29 per cent. over the preceding year, when 3,548,229 units were sold. They had received an increased revenue from private lighting of £6,451, from power £8,055, and from public lighting £213. The cost of coals had increased by £2,188, they having consumed 3,458 tons more than in 1905, and the price having gone up. The net profits for the year amounted to £50,176, to which had been added the balance brought forward from last year £4,358, and after deducting the interim dividend paid, there remained an available balance of £39,486. The directors recommended that £12,000 should be placed to reserve, and that a dividend of 10½ per cent. for the half-year be declared, making with the interim dividend 8½ per cent. for the year, and carrying forward of £5,206 to next year's account. He was pleased to say that the new stations at Howrah and Ultadangha had been completed, and were now supplying electricity. On obtaining a fresh licence from the Government the directors intended to reduce the power rate.

Mr. P. V. LUKE seconded the motion, and the report was adopted.

Buenos Ayres and Belgrano Electric Tramways. Co., Ltd.

THE meeting was held on 7th inst. at Winchester House, Mr. J. B. Concanon presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, April 26th, page 693), said that if the resolution which would be submitted that day for the sale of the company were carried, the accounts would not assume their usual importance, but they were of considerable interest as a guide in helping the shareholders to form a decision on so vital a question. The results of that year's working were, to put it mildly, disappointing, for although the traffic receipts showed an increase of £10,842, the total expenditure was greater by £15,853, resulting in a net decrease of profits of £5,012. This was owing partly to the increase of 6·6 per cent. in the number of miles run, whereas the total expenses showed an increase of 14·8. The inequality between increased mileage and increased expenditure was due to three main causes, viz.: (1) Higher wages; (2) increased cost of current; and (3) the larger amount spent on maintenance. Last year he made some reference to the labour question, and he was sorry to say that their fears were realised sooner than they expected. The result was a considerable addition to the wages bill, and there was no prospect of any reduction this year. On the contrary, the wages would show a further addition, as the increase was only in operation for nine months of last year. As regarded additional cost of current, this was due to the increased cost of fuel and the greater consumption per car-mile. If they continued to work the lines, they would have a sensible reduction of consumption due to a sub-station being erected, but that would give no relief in the current year, because while they did not feel the increased cost of coal till November in the present year, they would have to bear the difference between 24s. and 32s. per ton. Maintenance cost £2,353 more than in 1905, and they could hold out no hope of any material reduction. With regard to the scheme, the Buenos Ayres Co. had an amount of £200,000 payable immediately, which was equivalent to £70,000 a year for the property. If they looked at the report, they would notice that the gross profit on last year's working amounted to £70,786, and this amount was reducible by amounts to be set aside for renewals, which in the current year would not fall far short of £10,000, and would be more in future years, so that they would be, in fact, getting an immediate rental of £10,000 per annum more than they would earn, as the directors were not hopeful of doing much better in the period if they continued to work the tramways. When the present current contract expired they would, under ordinary conditions, be able to effect considerable economy in the cost, either by obtaining a more favourable contract with the power company or

by erecting a power station of their own, although the latter expedient would mean the raising of additional capital. They might fairly look to continued improvement in the gross and net receipts if they could keep the ever-growing expenses within reasonable bounds, but the conditions under which they were working in some respects were exceptionally unfavourable, and particularly in regard to the fares they charged. They charged 4d. for a journey of 8 miles while other companies charged 2d., and accordingly the Press were constantly drawing unfavourable comparisons, and the municipal authorities were worrying them. If they reduced to 2d. it would wipe out the dividend on the ordinary shares and imperil the full dividend on the preference shares. The ordinary shareholders at all events had no cause for dissatisfaction with the scheme, as when the purchase was completed they would receive at least £4 5s. per share, and get a safe 4 per cent. in the meantime. With regard to the preference shareholders, he admitted that they had a grievance, and the board discussed several expedients with a view of endeavouring to secure some premium on their shares at the completion of the purchase, but they found that there was no way of getting over the articles of association. The only consolation was that it was unlikely the sale could be completed for two years, and up till then they would receive a safe 6 per cent. dividend. On the other hand, if the company continued to work the tramways, it was quite unlikely that they could increase the present dividend of 3 per cent. on the ordinary shares for some years; it was quite conceivable that they might have to reduce it, and this would affect the market value of the preference, as well as the ordinary, shares. Some shareholders might ask why, if the board deemed it wise to sell, should purchasers think it worth their while to buy. His answer was that their company formed part, although not a large part, of a comprehensive programme to amalgamate all the tramways in Buenos Ayres, and, in addition to the saving in the cost of administration expenses, this would lead to greater facilities for the linking up of services. In conclusion, the chairman referred to the financial strength of the company which was purchasing the undertaking, to show that shareholders were properly secured.

Mr. ANDERSON seconded the adoption of the report, which was carried unanimously.

Other formal business having been transacted, the Chairman moved:—

That the agreement for the sale of the undertaking of the company dated April 20th, 1907, and made between the company of the one part, and La Compagnie Générale de Tramways de Buenos Ayres of the other part be, and the same is hereby approved, and that the directors of the company be, and they are hereby authorised to carry the same into effect.

Mr. H. BROWN seconded the motion.

Mr. G. KITCHIN said he desired to enter a strong protest in regard to that agreement so far as it affected the preference shareholders. He was sorry to see a board of such commercial and financial standing in the City of London, prepared to perpetrate what was really an act of robbery as affecting the preference shares. A number of these shares had been bought at £6 and over, and the purchasers thought they were buying shares in a company earning a fair dividend, but under this arrangement the buyers of the undertaking were to have the option of calling on the preference shareholders to sell their shares at par without any compensation. In other words, they were to be called to give up 20 to 25 per cent. in order that the ordinary shareholders might get out of what they considered was a not too high class investment.

The CHAIRMAN said he could only say he sympathised very keenly with the preference shareholders, and so did his colleagues. Personally, his holding was considerably larger in preference shares than in ordinary. They felt that the preference shareholders had a grievance, and they tried to get over it, but the lawyers said it could not be done under the articles of association. They proposed to alter the articles, but were again advised that the ordinary shareholders would naturally object, and the Courts would not allow it. Therefore they were forced into the position of either rejecting the proposal for sale at any price, or accepting it. It had to be remembered that the ordinary shares were £500,000, as against £327,500 preference, and had it come to the knowledge of the ordinary shareholders that they had refused the offer, they would, of course, have turned them out and put others in their place. The preference shareholders for the last eight or nine years had received their full 6 per cent. dividend, while the ordinary shareholders had only received an average of 1½ per cent.

The resolution was carried with one disentient.

A meeting of the holders of the 5 per cent. first debenture stock was afterwards held, when the following resolution was agreed to, on the motion of the CHAIRMAN:—

That the agreement dated April 20th, 1907, and made between the Buenos Ayres and Belgrano Electric Tramways Co., Ltd., of the one part, and La Compagnie Générale de Tramways de Buenos Ayres of the other part, be and the same is hereby approved. And that the company be, and is hereby authorised, to apply forthwith the sum of £200,000 part of the purchase money payable thereunder towards the redemption *pari passu* of the first debenture stock of the company at the price of £115 for every £100 stock, and to redeem the residue of the said first debenture stock, and also the second debenture stock of the company in the manner provided by Clause 8 of the said agreement, any stocks redeemed on or after January 1st, 1930, being redeemed at par.

Subsequently a meeting of the second debenture-holders was held, and a resolution approving of the scheme was agreed to.

Brush Electrical Engineering Co., Ltd.

THE eighteenth report to be presented at the annual general meeting to be held at Salisbury House, on May 23rd, states that the profit and loss account for the year ended December 31st, 1906, shows a gross profit of £73,711 general charges, maintenance, interest on debenture stock, and £6,500 carried to depreciation reserve fund, absorb £49,526, leaving a net profit of £24,184. The general reserve fund has been reduced by the sum of £6,891, being losses accumulated since October 31st, 1904, in connection with the company's Australasian branch, and part of the expenses of closing that branch. This business has now been placed upon a different footing by the appointment of agents. This fund has also been debited with £13,593 for preliminary expenses, experiments and excess cost of work carried out during the year on new lines of manufacture (principally main line rolling stock and commercial motor vehicles) entered upon by the company in consequence of a diminution in the demand for tramway rolling stock. It would be permissible to write off these charges over a term of years, but the directors have decided to at once extinguish them by taking the full amount from the general reserve fund. The directors are of opinion that the experience gained in dealing with this new work will prove to be of great value to the company in the future. In view of the depreciation in the value of the company's investments, to which the auditors call special attention in their certificate, the directors have determined to adopt a conservative policy, and recommend that the profits of the year, £24,184, be appropriated as follows:—To general reserve fund, £21,484; to balance carried forward, £2,700. The depreciation reserve fund will then stand at £58,500, and the general reserve fund at £25,000. The sum of £22,823 has been expended on capital account on additions to plant and buildings during the year. The directors report that while the works have been very fully occupied during the year on important contracts, the amount of net profit has been seriously affected by the continued strenuous competition, by the strike of a number of workmen employed in the company's car-building shops, and by the onerous terms, due to the condition of the money market, upon which money has had to be borrowed to provide the additional capital required for the increasing business which the company now commands. A lease of the works and business of the British Automobile Development Co., Ltd., has been acquired, and the company is now in a favourable position to manufacture and supply the latest and most approved types of motor omnibuses, lorries, and other commercial motor vehicles.

The auditors' certificate reads as follows:—

In accordance with the provisions of the Companies' Act, 1900, we certify that all our requirements as auditors have been complied with, and we report to the shareholders that we have audited the above balance-sheet, with the accounts relating thereto in London, with the accounts of the Australian branch for the two years ending October 31st, 1906, certified by local auditors, and with accounts from the Bombay branch signed by the company's representative. The stock has been taken by employés of the company and the summary of the stock signed by the secretary and assistant manager. The shares and debentures, all of which are entered in the balance-sheet at or below cost price, have, as to about three-fourths of them, published prices, and the values at such prices show a large reduction upon the figures in the accounts. We are unable to verify the value of those not having published prices, but with the exception of one item of £10,000 they appear to be of small value. The item of patents and goodwill remains at £181,397 8s. 9d., the figure at which it stood at June 30th, 1897. During the year further patents have been allowed to lapse, and various other patents have been acquired. Subject to the above remarks, in our opinion such balance-sheet is properly drawn up so as to exhibit a true and correct view of the state of the company's affairs as shown by the books of the company.

COOPER BROTHERS & Co.

Companies to be Struck off the Register.—The names of the following companies are to be struck off the register within three months unless cause is shown to the contrary:—

Albert Electric Lighting Co., Ltd.
Automatic Smoke Prevention Synd., Ltd.
British Electric Installation Contractors, Ltd.
City of Bath Electric Lighting and Engineering Co., Ltd.
Collier Audible Telephone Synd., Ltd.
Epstein Electric Accumulator Co., Ltd.
Fowler Insulator Syndicate.
Home Telephone Co., Ltd.
International Electric Synd., Ltd.
Lithanode and General Electric Co., Ltd.
Lodge Electric Light and Power Co., Ltd.
London Lighting and Engineering Co., Ltd.
New British Electric Installation Contractors, Ltd.
R. C. Cutting, Douglass & Co., Ltd. (registered May 11th, 1902).

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the three months ended March 31st last.

Brisbane Electric Tramways Investment Co., Ltd.—The report for 1906 states that the dividends on the shares held by this company for 1906 amount to £49,966. There is a balance to credit of revenue account of £52,640, and a net balance available of £47,282. The debenture stock interest has absorbed £18,703, and an interim dividend has been paid on the preference shares amounting to £8,906. The directors recommend payment of the balance dividend on the preference shares, making the full rate of 5 per cent. per annum, and a dividend at the rate of 2 per cent. per annum on the ordinary shares, carrying forward £2,267. The annual meeting was held in London on Wednesday.

Castner-Kellner Alkali Co., Ltd.—Interim dividend for the six months ended March 31st, at the rate of 8 per cent. per annum.

Prospectus.—*The Renard Road and Rail Transport Corporation, Ltd.*—This company has this week been before the public with an issue of 125,000 preferred shares (£1) to receive 7 per cent. per annum, plus one-third of the remaining net profits, after 7 per cent. has been paid on the ordinary. The list of directors includes the name of Mr. Philip Dawson, and the consulting engineers are Col. Crompton and Mr. B. H. Thwaite. The nominal capital is £250,000, and the purchase price has been fixed at £185,500, payable as to £60,500 in cash, and the balance in £125,000 fully-paid ordinary shares. The list was to close on Wednesday.

MARKET QUOTATIONS.

Wednesday, May 15th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	,, Nitric	per cwt.	22/-	..
a	,, Oxalic	per cwt.	82/-	..
a	,, Sulphuric	per cwt.	5/6	..
a	Ammoniac, Sal	per cwt.	42/-	..
a	Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a	,, ,, ...	per ton	£30	..
a	Bleaching powder	per ton	£5 10	..
a	Bisulphide of Carbon	per ton	£18	..
a	Borax	per ton	£15	..
a	Copper Sulphate	per ton	£33 10	£1 inc.
a	Lead, Nitrate	per ton	£33 10	£1 dec.
a	,, White Sugar	per ton	£25	..
a	,, Peroxide	per ton	£32	..
a	Methylated Spirit	per gal.	2/6	..
a	Potassium Bichromate, in casks	per lb.	3½d.	..
a	Potash, Caustic (75/80 %) ..	per ton	£20	..
a	,, Chlorate	per lb.	3½d.	..
a	,, Perchlorate	per lb.	9d.	..
a	Potassium Cyanide	per lb.	7½d.	..
a	Shellac	per cwt.	220/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a	,, Recovered	per ton	£5 10	..
a	,, Lump	per ton	£5	..
a	Soda, Caustic (white 70 %) ..	per ton	£10 15	..
	,, Chlorate	per lb.	3½d.	..
a	,, Crystals	per ton	£3 5	..
a	Sodium Bichromate, casks ..	per lb.	3d.	..
a	,, Cyanide (basis 100 %) ..	per lb.	7d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots ..	per ton	£200	..
b	,, Wire, in ton lots ..	per ton	£220	..
b	,, Sheet, in ton lots ..	per ton	£210	..
p	Babbitt's metal ingots	per ton	£61 to £203	..
c	Brass (rolled metal 2' to 12') basis	per lb.	11¼d.	..
c	,, Tube (brazed)	per lb.	1/0½	..
c	,, ,, (solid drawn) ..	per lb.	11¼d.	..
c	,, Wire, basis	per lb.	11d.	..
c	Copper Tubes (brazed)	per lb.	1/2	..
c	,, ,, (solid drawn) ..	per lb.	1/2½	..
g	Copper Bars (best selected) ..	per ton	£118	..
g	Copper Sheet	per ton	£120	£4 inc.
g	,, Rod	per ton	£118	..
e	,, (Electrolytic) Bars ..	per ton	£117	..
e	,, ,, Sheets ..	per ton	£125	..
e	,, ,, Rod ..	per ton	£121	Dec.
e	,, ,, H.C. Wire	per lb.	1/2	Dec.
f	Ebonite Rod	per lb.	8/8	..
f	,, Sheet	per lb.	8/-	..
n	German Silver Wire	per lb.	1/8	..
h	Gutta-percha, fine	per lb.	5/5 to 6/6	6d. inc.
h	India-rubber, Para fine	per lb.	4/9½ to 4/10	Dec.
i	Iron, Charcoal Sheets	per ton	£18	..
i	,, Pig (Cleveland warrants)	per ton	62/9	4/10d. inc.
i	,, Forgings, according to size	per ton	From £11	..
i	,, Scrap, heavy	per ton	47/6 to 50/-	..
i	,, Wire, galvanised No. 8 ..	per ton	£9 15	..
g	Lead, English Ingot	per ton	£20 13 9	Inc.
g	,, ,, Sheet	per ton	£20 2 6 to £20 5	Inc.
m	Manganin Wire No. 28	per lb.	8/	..
g	Mercury	per bot.	£7	..
d	Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d	,, ,, ,, medium	per lb.	2/6 to 4/-	..
d	,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p	Phosphor Bronze, plain castings	per lb.	1/4½ to 1/6½	..
p	,, rolled bars & rods	per lb.	1/5½ to 1/6½	..
p	,, ,, strip & sheet	per lb.	1/6 to 1/10	..
o	Platinum	per oz.	..	..
e	Silicium Bronze Wire	per lb.	1/3½	..
e	Steel, Magnet, ace'd'g to desc'p'n	per ton	£68	..
	,, ,, in bars		£15 to £40	..
g	Tin, Block (English)	per ton	£192 to £193	£7 dec.
n	,, Wire, Nos. 1 to 16	per lb.	2/3½	½d. dec.
p	White Anti-friction Metals—			
	"White Ant" brand	per ton	£61 to £85	..
k	Zinc, Sh's (Vieille Montagne bnd.)	per ton	£30 10	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, G.P. and Teleg. Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.

Smithfield Markets Electric Supply Co., Ltd.—Mr. H. S. Leon presided at the adjourned ordinary general meeting of this company, held on May 11th. A full report of the earlier proceedings will be found in the ELECTRICAL REVIEW of February 22nd. It will be remembered that the adjournment took place because of the decision of the board to pass the dividend on the ordinary shares. Messrs. Brougham Glasier and Butlin, as shareholders' deputation, have since conferred with the board as arranged, and counsel's opinion has again been taken, with the result that on Friday last the deputation reported that it was quite clear that the directors would not be justified, under the circumstances, in declaring a dividend on the ordinary shares. The report and accounts were then adopted.

STOCKS AND SHARES.

Tuesda Evening.

BESIDE the collapse in Home Railway securities, other Stock Exchange matters this week, up to the present, look insignificant. The stocks in all our principal railway companies have been steadily falling for some time past, but the hint of a general strike involving all the railways has been the signal for a thorough debacle from which scarcely one price escaped. Falls are in varying degrees, but the electrical stocks, on the whole, have suffered least.

Central London Deferred, however, has relapsed to 53½, a drop of 3 points, and the Ordinary is not better than 72. Some attempt was made to explain this particular movement by a reference to the Euston extension of the City and South London, but we fail to see how the two can have any connection. The more humdrum explanation, that the traffic decreases are frightening holders and restraining buyers, is much more feasible. City and South London Ordinary changed hands at 41⅜ on Monday, the day of the public opening of the extension. It is natural that stockholders want to know in what way the additional expenditure is to be financed. Metropolitan Consolidated sank to 43. Districts were 14. The 5 per cent. Notes of the Underground Electric Railways lost 2 at 75½.

The last-named company and the North-Eastern Railway are said to be the only two railway companies in England that recognise the "union" of the men. It is, at least, a coincidence that Sir George Gibb was manager of the North-Eastern before he came south to take up his present prominent position with regard to the District and its group.

Charing Cross, Euston and Hampstead 4 per cent. Debenture stock is nominally 83-86, which is two points below the quotation for the Great Northern, Piccadilly and Brompton 4 per cent. Debenture. The interest upon both is due January 1st and July 1st. Great things, of course, are expected from the opening of the Charing Cross Railway next month, which will complete the last link in that particular group of "Tubes." But maybe there is no particular hurry to buy these stocks yet: prices might go lower unless the traffics took an unexpected and substantial turn for the better. And this, in the summer-time, does not seem highly probable.

In the electricity supply list, it will be noticed that Edmundson's are still very flat. Where prices are so nominal, the best test of dealing is to be found in the markings of actual business done, and Edmundson's Preference were sold early this week at 45s. They can now be bought at this price, and Ordinary at 1½. Chelsea Ordinary have been dealt in at 3⅞, and Charing Cross Preference at 4⅜. Business in this section, however, is about as depressed as it possibly can be. A few of the "foreign" issues are more negotiable than the stocks and shares of companies working in London. Mexican Electric 5 per cent. First Mortgage bonds are better at 76½, and Mexican Light and Power Ordinary has advanced to 47s.

British Electric Tractions continue to pursue their downward track, and the Ordinary fell to 2¼. By this time, all hope of a dividend on the shares this year has been abandoned; it remains to be seen whether the Preference interest will be paid in full. The Brush Company has had to pass its Preference dividend this time, and the Ordinary have fallen to 10s., the Preference to 25s. Both of these, moreover, are very nominal prices. Cape Electric Trams fell to 8s. 9d.; someone facetiously suggested it was because of the repatriation of the Chinese from the Rand! The Argentine group of traction issues is steady.

The Telegraph market is one of the firmest in the weak Stock Exchange. Anglo-American Deferred fell a trifle to 20⅞ upon liquidation of speculative accounts. West Coast of America shares improved to 1¼, and Eastern Extensions to 13¾. Great Northerns fell £1 to 35. Globes have not changed, but Submarine Cables Trust Certificates rose 2 points upon the recent satisfactory report.

Callender's Cable Company announces a dividend, making 10 per cent. for the year, and a bonus of 5s. a share, being a repetition of last year's excellent performance. The price of the Ordinary shares keeps at 10½. Miscellaneous and manufacturing descriptions are quiet, and there is no especial feature, apart from the fall in Brush shares, already noticed.

Globe Telegraph and Trust Co., Ltd.—The financial year will in future be closed on May 31st instead of April 30th, and the final dividends will be paid at the end of June, those in June next being for the four month to May 31st, and the interim quarterly dividends will in future be paid on September 30th, December 31st and March 31st.

Belgium.—La Société des Accumulateurs Tudor, of Brussels, reports a profit of £4,550 for the last financial year.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations May 7th.	Closing Quotations May 14th.	Business done week ended May 14th, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149 600	Do. do. 5 % Debs., Nos. 1 to 1,950 Red.	100	Nil	Nil	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11
660,660	Anglo-American Telegraph	Stock	61s.	2½%	3½%	3½%	61½ — 64½	61¼ — 64½	63	62	..	6 0 2
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	6½%	6 %	6 %	106½ — 107½	106½ — 107½	107½	106½	..	5 11 4
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	½%	12½%	20½ — 21½	20½ — 21	21	20½	— ½	8 6 8
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	..	99 —101	99 —101	..	..	..	4 19 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6½ — 7½	6½ — 7½	6 13/16	..	..	5 10 4
2,097,680	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	93 — 95	92½ — 94½	93	..	— ½	4 4 8
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	8 — 8½xd	8 — 8½	..	..	..	5 17 8
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	16 — 17 xd	16 — 17	..	..	..	5 17 8
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅜ — 3⅝	3⅜ — 3⅝ xd	67/6	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½ — 9¼	8½ — 9¼ xd	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	100 —103	..	..	+½	4 7 5
60,710	Direct United States Cable	20	3 %	3½%	4½%	..	15½ — 16	15½ — 16	15⅝	15½	..	5 6 3
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	139 —144	139 —144	142½	141½	..	4 17 3
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	89 — 91	89 — 91	90⅝	..	..	8 16 11
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	104½ —106½	104½ —106¼ xd	..	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	13½ — 13⅝	13⅜ — 14	13⅜	13⅜	+ ¼	5 0 0
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105 —107	105 —107	105⅝	..	..	3 14 9
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	93 —101	98 —101	..	..	..	3 19 3
2 10,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	98 —100 xd	98 —100	..	..	..	4 0 0
131,127	Globe Telegraph and Trust	10	5½%	5⅝%	5½%	..	10⅝ — 11⅛	10⅝ — 11⅛	11	..	..	4 18 10
131,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	..	13⅞ — 14⅜	13⅞ — 14⅜	..	..	..	4 3 6
150,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	24 %	24%	20 %	35 — 37	34 — 36	..	..	—1	5 11 1
88,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100—102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	10 %	18 %	13 %	13 %	59 — 61	59 — 61	59	..	..	5 6 7
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜ — ⅜	⅜ — ⅜	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	8 %	4 %	5 %	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	..	¾ — 1	¾ — 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108 —110	108 —110	109	108½	..	5 9 1
2,225 000	Do. do. Def. Stock	100	5 %	5 %	5 %	5½%	104½ —106½	104½ —106½	106	105⅝	..	5 3 4
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11½ — 13½	11½ — 13½	11	10⅞	..	4 8 11
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 5/16 — 5 7/16	5 5/16 — 5 7/16	5 7/16	5 3/16	..	4 9 11
2,000,000	Do. do. 8½ % Deb. Stock Red. ..	Stock	8½%	8½%	8½%	8½%	96½ — 97½	96⅛ — 97½	9 1/16	96½	..	3 11 10
1,689,598	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101½	101¼	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6½%	6½%	7½%	7 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	28/-	..	..	5 4 4
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1½ — 1¾	1½ — 1¾	22/9	..	..	4 16 0
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	4 %	4 %	95 — 98	95 — 98	97½	95½	..	4 1 8
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
11,889	Reuter's	8	5 %	5 %	5 %	..	7½ — 8½	7½ — 8½	..	..	..	4 14 1
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
8,167	Submarine Cables Trust	Cert	6 %	6 %	6 %	6 %	125 —128 xd	127 —130	..	..	+2	4 12 4
80,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞ — 7⅛	6⅞ — 7⅛	7 1/16	7	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5 — 5⅛	5 — 5⅛	5⅛	..	+ ⅛	4 10 11
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	109 —112	109 —112	109⅜	..	..	4 9 3
15,609	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10½	10 — 10⅛	..	..	..	3 16 2
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2	Nil	Nil	Nil	2½%	1 — 1⅛	1⅛ — 1⅜	25/-	21/3	+ ⅛	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13⅜ — 14⅛	13⅜ — 14⅛	13 1/16	13 1/16	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —105	102 —105	102	..	..	3 16 2
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	7 %*	6 %	5 %	8 %	8 — 8½	8 — 8½	..	..	..	9 8 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6½ — 7½	6½ — 7½	..	..	— ½	Nil
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17

Including arrears.

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

70,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 550,008 to 580,007	..	..	8 %	8 %	8 %	7 7/16 — 7 7/8	7 7/16 — 7 7/8	7 7/8	7 7/8	— 1/16	5 4 1
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	5⅞ — 6	5⅞ — 6	5 29/32	5 25/32	..	4 11 8
266,600	Do. Permanent, 5 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	133 —136	133 —136	134	..	..	4 8 3
285,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	105	104	..	4 13 6
830,000	Babcock & Wilcox, 1 to 830,000	1	17 %	20 %	20 %	20 %	3⅞ — 4	3⅞ — 4	78/9	76/3	..	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16 — 1 9/16	1 7/16 — 1 9/16 xd	30/-	..	..	3 15 7
88,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅛	5⅛	..	6 1 9
40,000	Do. do. 7 % Cum. Pref.	5	Nil	7 %	7 %	..	5⅞ — 6⅛	5⅞ — 6⅛	6 1/16	..	..	5 12 0
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	5¼ — 5½	5¼ — 5½	..	..	..	5 4 4
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	..	4 — 4¼	4 — 4¼	..	..	..	4 8 11
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	101 —105	101 —105	..	..	..	4 15 8
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	98 —101	98 —101	..	..	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	6 %	123 —127	123 —127 xd	..	..	..	4 14 6
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	106 —111	106 —111	..	..	..	4 10 1
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	102 —106	102 —106	..	..	..	4 14 4
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	99 —102	99 —101	..	..	— ½	4 8 8
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102¼ —104½	102¼ —104½	..	..	..	4 9 1
188,801	British Electric Traction	10	6 %	6 %	3 %	..	2⅜ — 2⅝	2⅜ — 2⅝	50/-	42/6	..	10 18 2
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	6¼ — 6⅝	6¼ — 6⅝	6⅛	6¼	..	8 17 9
1,448,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	100—104	99 —103	100⅜	100	—1	4 17 1
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	..	79 — 82 xd	79 — 82 xd	80⅛	..	..	5 9 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6¾ — 7	6¾ — 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞ — 6¼	5¾ — 6¼	..	..	..	4 16 0
600,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	92 — 96	94 — 98	..	..	+2	4 11 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1⅛	1 — 1⅛	26/8	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	64 — 68	64 — 68	..	..	..	5 17 8
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	10/ — 11/	9/— 11/	..	..	..	Nil
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	2½%	..	⅝ — ¾	½ — ¾	..	..	— ¼	6 13 4
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1½ — 1¾	1 — 1½	29/3	..	— ¼	8 0 0
125,000‡	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	89 — 92	89 — 92	..	..	..	4 17 10
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	75 — 78	75 — 78	..	..	..	5 15 5
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	8 %	4 %	3 %	8 %	3¾ — 4	3¾ — 4	73/1½	72/4½	..	3 15 0
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	5 — 5⅛	5 — 5⅛	5 1/16	5	..	5 14 3
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅞ — 5⅛	4⅞ — 5⅛	5 1/16	..	..	5 12 11
13,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	104 —106	105 —107	..	..	..	4 18 6
190,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2
137,610	Calcutta Trams., 1 to 137,610	5	6 %	8 %	8 %	8 %	7⅞ — 8 xd	7⅞ — 8	8⅜	7 7/8	..	5 0 0
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	..	5 %	5 %	5⅝ — 5¾	5⅝ — 5¾	5 7/8	5 7/8	..	4 6 11
860,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 8 4
85,000	Callender's Cable Construction shares	5	12½%	12½%	15%	15 %	10 — 11	10 — 11	..	..	..	6 16 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106¾ —108½	106¾ —108½	..	..	..	4 2 11
491,229	Cape E. Trams., 1 to 491,229	1	10 %	5 %	Nil	..	3/16 — 5/16	3/16 — 5/16	3/-	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	8 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	23/7½	25/3	— 1/16	5 16 4
234,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102	..	..	..	4 8 8
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	74 — 76	71 — 73	73½	72½	—3	5 9 7
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	..	..	..	4 5
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	55 — 58	52 — 55	..	..	—3	7 5 6
1,490,000	City and South London Railway	Stock	2½%	2½%	1½%	2½%	41 — 43	41 — 43	42½	41½	..	4 18 10
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	2½%	2½%	..	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	8 10 2
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	97½	..	..	5 1 0

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(Continued.)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations May 7th.	Closing Quotations May 14th.	Business done week ended May 14th, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1⅝ — 1⅝	1⅝ — 1⅝	...	..	..	7 15 4
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1½ — 1¾	1½ — 1¾	..	..	..	4 16 0
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	102 —105	102 —105	104½	104½	..	4 5 9
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5½%	6 %	6 %	..	14⅛ — 15½	14⅛ — 15½	..	..	..	3 18 8
59,987	Do. 6% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13⅝ — 14⅜	13⅝ — 14⅜	..	..	..	4 2 9
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	6	Nil	2½%	4½%	..	1 — 1⅛	1 — 1⅛	..	..	— ⅛	9 3 9
17,189	Do. "A" shares, 01—017,189	5	Nil	2½%	4½%	..	2½ — 2⅞	2½ — 2⅞	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	89 — 92	89 — 92	..	..	..	5 8 8
112,100	Electric Construction 1 to 112,100	2	4 %	Nil	Nil	..	1 — 1⅜	1 — 1⅜	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	..	1½ — 2	1½ — 2	..	..	..	7 0 0
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	81 — 84	81 — 84	..	..	..	4 15 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8⅞ — 9⅜	8⅞ — 9⅜	9 1/16	..	..	5 2 4
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	92 — 95	92 — 95 xd	..	..	..	4 4 3
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	3 %	4 %	4 %	4 %	2½ — 3	2½ — 3	..	..	..	11 0 0
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10⅝	10½ — 10⅝	..	..	..	6 13 4
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	11⅞ — 12⅜	11⅞ — 12⅜	11⅞	..	..	5 17 8
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	3 15 7
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	..	..	..	4 2 7
60,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10%	5 %	10%	10 %	15½ — 16½	15½ — 16½	15⅝	..	..	6 3 1
87,500	†Liverpool Overhead Railway, Ord.	10	12½	Nil	Nil	Nil	1½ — 1⅝	1½ — 1⅝	..	..	..	Nil
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	6 — 7	6 — 7	..	..	..	7 8 2
600,070	London United Trams (1901), 1 to 50,007	10	8 %	6 %	8 %	8 %	7 — 8	7 — 8	8 1/16	8⅛	..	8 15 6
899,930	Do. do. 50,008 to 100,000	10	8 %	6 %	8 %	8 %	7 — 7⅛	7 — 7⅛	..	..	..	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	5 14 3
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	84 — 89	85 — 89	85½	85	+ ½	4 9 11
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
600,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	31/32 — 32/32	31/32 — 32/32	18/3	..	..	5 3 11
350,000	Do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	96 — 99	96 — 99	97	..	..	4 10 11
30,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	4 — 4¼ xd	4 — 4¼	..	..	..	7 10 0
245,500	Potteries E. Trc.	1	5 %	5 %	4 %	4 %	3/32 — 4/32	3/32 — 4/32 xd	..	..	..	6 8 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	2/32 — 3/32	2/32 — 3/32	18/3	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98½—101½	98½—101½	..	..	..	4 8 8
37,850	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	30 — 32	30½ — 32½	31½	31	+ ½	5 11 1
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100½—101½	100½ —102½	..	..	+1	3 17 4
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	5 %	5 %	5 %	76 — 79	74 — 77	..	..	—2	6 9 0
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	1½ — 1⅝	1½ — 1⅝	..	..	..	Nil
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3½ — 4½	3½ — 4½	..	..	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	79 — 83	79 — 83	..	..	..	4 16 5

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5½%	5½%	5½%	4⅜ — 5¼	4⅜ — 5¼	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99 xd	..	..	..	4 10 11
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	8 — 9	8 — 9	..	..	..	5 11 1
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 8	7⅜ — 8⅜	..	..	..	4 2 4
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	+ ½	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	8 %	8 %	5 %	5 %	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4⅜	4 — 4⅜	87/6	81/3	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 5 11
427,400	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	96½	96	..	4 0 10
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3⅞ — 4⅛	3⅞ — 4⅛	77/6	..	..	4 14 9
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	106	105	..	4 4 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	9⅞ — 10⅜	9⅞ — 10⅜	10 1/16	10 1/16	— ⅛	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11½ — 12½	11½ — 12½	..	..	..	4 18 0
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —125	123 —125	..	..	..	3 19 4
800,000	Do. 4½ % 2nd Db. Stk., Prov. Cris., all pd.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
40,000	County of Durham Electrical Power, Ord.	5	4 %	£3 7 0	4 %	4 %	4⅜ — 5	4⅜ — 5	..	..	..	4 0 0
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	8 — 8½	7⅞ — 8⅛	..	..	— ¼	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅜	10⅜ — 11⅜	..	..	..	5 4 4
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	106½	106	..	4 2 7
400,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	95 — 98	95 — 98 xd	97	95	..	4 11 10
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	4 %	..	1 — 2	½ — 1½	..	..	— ½	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	2 — 3	1½ — 2½	..	..	— ½	10 14 5
350,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	87 — 90	87 — 89	50/-	45/-	..	5 1 2
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝ — 5⅜ xd	4⅝ — 5⅜	..	..	..	5 2 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 15 8
90,000	Do. 4½ % 1st. Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
18,000	Hove, 1 to 18,000	5	8½%	8½%	9 %	9 %	7 — 7⅛ xd	7 — 7⅛	..	..	..	6 0 0
21,000	Kensington and Knightsbridge Electric Ord.	5	12½%	12 %	10 %	10 %	8⅜ — 9⅛	8⅜ — 9⅛	..	..	..	5 0 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	8	Nil	8 %	4 %	4 %	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	5 6 8
70,000	Do. do. do. 6 % Pref..	5	6 %	6 %	6 %	6 %	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	5 14 3
874,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	95 — 98	95 — 98	..	..	..	4 11 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8½%	10 %	10 %	8 %	6 — 7	6 — 7	6⅛	..	..	5 14 4
76,121	Do. 4½ % Cum. Pref. 1—71,108	5	4½%	4½%	4½%	4½%	4⅝ — 5⅛	4⅝ — 5⅛	5 1/16	..	..	4 3 9
220,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	106 —110	106 —110	..	..	..	4 1 10
250,000‡	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	3½%	89 — 93	88 — 92	..	..	—1	3 16 1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	7½ — 7⅝	7⅞ — 7⅞	..	..	..	5 3 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	5 %	5 — 5	5 — 6	..	..	..	4 3 4
10,858	Notting Hill Electric Lighting	10	6 %	7 %	7⅜%	7⅜%	12 — 13	12 — 13	..	..	..	5 15 5
64,000	Do. do. 4 % 1st Mort.Deb...	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6½%	7 %	7 %	7 %	5⅞ — 6⅛	5⅞ — 6⅛	..	..	..	5 9 10
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	12½%	10 %	7⅜ — 8⅛	7⅜ — 8⅛	..	..	..	5 17 8
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅜	6⅞ — 7⅜	..	..	..	4 13 4
150,000‡	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	92 — 95	91 — 94	..	..	—1	3 14 6
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
60,000	Do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	73 — 77	73 — 77	..	..	..	5 3 11
65,000	South London Electricity Supply, Ord.	5	3 %	4 %	4 %	3 %	2½ — 2⅝	2½ — 2⅝	..	..	..	5 9 1
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2½%	..	⅜ — ½	⅜ — ½	..	..	..	3 6 8
117,968	Do. Do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅝ — 1⅞	1⅝ — 1⅞	..	..	..	5 1 10
200,000	Do. Do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1½ — 2½	1½ — 2½	..	..	..	10 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	3 — 4	3 — 4	..	..	..	6 5 0
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
110,000	Westminster Electric Supply, Ord.	5	18½%	14 %	18 %	12 %	9 — 10	9 — 10	9 1/16	9⅛	..	6 0 0
81,279	Do do. 4½ % Cum. Pref. (Original 5%—Red. to 4½ % from 31st Dec., 1905.	5	5 %	5 %	5 %	5 %	4½%	5⅛ — 5⅜	5 1/16	..	..	3 18 3

Shares not officially quoted:—Mackay Companies, ord., 70—72 — 1½. Pref. 70—72 — 1½.
Unless otherwise stated all shares are fully paid. ‡ Interim dividends.

Bank rate of discount 4 per cent. April 25th, 1907

PROCEEDINGS OF INSTITUTIONS.

"Flexibles," with Notes on the Testing of Rubber.

By Prof. Alfred Schwartz, Member.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 18th*, 1907.)

I.—Introductory.

There is a general consensus of opinion amongst engineers that the flexible is the weakest part of an electrical installation. If this is so, we are ourselves largely to blame for our neglect of the matter. It is curious to reflect that, after the elaborate care that has been exercised to keep well-insulated conductors apart (when not enclosed in non-flammable tubes) in all other portions of the installation, we should have come to regard with complacency the violent forcing together of two comparatively poorly insulated conductors in positions where they are exposed to considerable heat and are liable to mechanical strains, as in the lamp-holder with single-hole cord grip so commonly employed at the present time.

On the Continent flexibles are employed more largely than in this country, in that their use is not restricted to lamps and portable appliances, but the wiring of the building itself is often carried out with flexibles supported on insulators. A good deal of foreign flexible finds its way to the English market, and many of the art fittings imported from the Continent are provided with flexibles, which, although they might be satisfactory when used under the strictly specified conditions in the country of their origin, are here subjected to voltages and conditions for which they were never intended, with disastrous results.

With regard to the use of flexibles for wiring installations, which has an added interest to us at the present time, in view of the desirability of cheapening the cost of wiring to small consumers, it has been found in Germany that unless the regulations laid down concerning this material (see Appendix) are closely adhered to and the best material employed, trouble is likely to ensue.

In the early days, when 110 volts only had to be dealt with, flexibles insulated with lapped rubber tape were successfully employed. When, however, 220 volts came into use, this class of insulation was found to be insufficient, the faults mostly occurring in the switch wires.

A fault short-circuiting the lamp or other consuming device would allow of a considerable current rush, and blow the fuses; whereas, if a short occurs in the switch wire only the switch is short-circuited, and the current in the arc is limited to that of the lamp or consuming device in the circuit. The arc thus formed travels slowly up the wires until the lamp leads are involved, when the fuses will blow.

It is not unusual in Lancashire cotton mills, where the air is highly charged with moisture, and the flexibles are regularly brushed down in order to rid them of the adherent fluff with the brush used for cleaning down the machines, which is in consequence oily, to find that persistent arcs of low current value, and too small to blow the circuit fuses, are formed in the flexibles for pendant lamps. The arc travels up the flexible in the manner already referred to, but the limitation of the current in this case is due to the formation of a high-resistance arc across the carbonised insulation. In mill and factory lighting it is impossible for economic reasons to employ only 5-ampere circuits where long aisles are to be lit, consequently the blowing of a fuse brought about by the failure of a flexible may extinguish a large number of lights. A return to the practice of fusing ceiling roses would therefore seem to be desirable in such cases.

II.—Conductors.

The conductors for flexibles are usually all twisted in one direction; they are sometimes, however, not twisted at all. The latter form is not desirable for any conductor that has to work backwards and forwards over a pulley, as the stress is not distributed evenly over the wires, which in consequence are liable to break.

There are four causes of weakness in the conductors which would appear to operate in actual practice:—

1. Extension of the wires by bending when under small loads.—Ercolini has recently experimented with copper wire 0·04 cm. (16 mils) diameter wound upon iron cylinders, 1, 2, and 4 cm. diameter respectively, under tensions varying from 250 to 3,000 grammes (0·5 to 6 6 lb.). He found that with successive winding and unwinding the wire stretched as much as 84 per cent. before breaking, under a tension which produced an insignificant stretching if applied in the ordinary way.

2. Loss of tenacity due to increase of temperature.—The temperature attained in lamp-holders is very much higher than is generally supposed. It is, of course, a very variable quantity, depending not only upon the heat radiated and conducted from the lamp itself to the holder, but also upon the nature of the contact between the lamp terminal plates and the spring plungers of the holder. Actual tests on 100-volt lamps show that 8-c.p. lamps attain an average of 118° F. in the holder, with shade in position; 16-c.p. lamps, 143° F.; a 50-c.p. lamp, 329° F.; tantalum and Nernst lamps, up to 145° F.

Tests to determine the temperature attained in bayonet catch holders for electric radiator lamps show a maximum temperature of 221° F., but with faulty springs and oxidised contacts over 415° F. was attained. The plungers are directly connected to the flexible conductors, and the heat thus carried into the insulation is undoubtedly the cause of many breakdowns.

3. Corrosion of the Wires due to Sulphur from the Vulcanising Compound.—The vulcanising compound is usually put on in two layers, the outer one of which, or "jacket," may contain as much as 10 per cent. of sulphur, while the inner one, which is termed the "separator," may contain as much as 3 to 4 per cent. of sulphur. Then follows a layer of pure rubber tape on the tinned conductors. In old vulcanised flexibles, the wires are often blackened by the action of the sulphur, and become considerably more brittle than those insulated with pure rubber, and within a shorter time.

4. Corrosion of the Wires due to Chemical Fumes in the Air.—This is not usually a direct action, particularly in the case of vulcanised rubbers, but takes place in the presence of moisture, which leads first to the deterioration of the insulation, and subsequently to the corrosion of the wires by electrolytic action.

Gymp Flexible.—This is a special flexible which was brought to the author's notice by Mr. Mervyn O'Gorman. Owing to the structure of the conductors it possesses an extraordinary degree of flexibility.

The conductors are composed of flat copper strips, 10 mils wide and 1·5 mils thick. These strips are each wound in a close spiral around a separate silk core, and 21 of these are then stranded together in sets of seven to form the complete conductor. The resistance of such a conductor is naturally high, that of the small specimen submitted to the author after it had run 1½ million times over a counterweight pulley being 1·72 ohms per yard of double conductor.

In general the question of conductivity of flexibles as applied to pendants, &c., may be considered as being overridden by the requirements of mechanical strength, which will dictate the minimum section to be employed, but the conductivity is of considerable importance in connection with the use of flexibles for wiring systems.

III.—Heating of Conductors due to Excessive Currents.

This matter is of interest in connection with the temperatures attained with flexibles due to short-circuit currents, and the employment of heavy fuses on sub-circuits.

A series of experiments was made by the author and Messrs. F. Shaw and J. Davies on (1) the temperatures attained in a given time with bare conductors with various currents, (2) the corresponding temperature rises with the same conductor when insulated. The results of these experiments are shown graphically in figs. 1 and 2. As is to be expected, the temperature rise in a bare wire with a given current is higher than that of the same wire when insulated.

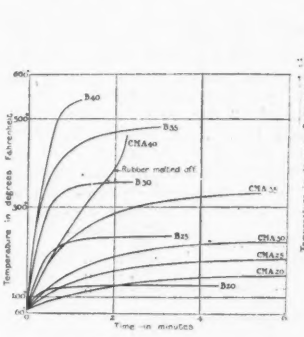


Fig. 1.

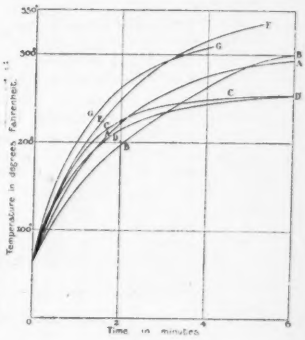


Fig. 2.

Fig. 1.—Temperature Rise on 23/36 Conductor with Currents of 20, 25, 30, 35, 40 Amperes.

B = Bare wire; C.M.A. = Cable Makers' Association V.I.R. covering only without braiding. Room temperature, 60° F.

Fig. 2.—Temperature Rise on 23/36 Conductor in Various Finishes with a Current of 30 Amperes.

A = C.M.A. twin-twisted glacé; B = C.M.A. workshop; C = C.M.A. same as A, but single conductor; D = C.M.A. twin-twisted silk; F = double pure rubber twin-twisted; G = single pure rubber twin-twisted.

These tests were designed to show the temperatures attained with comparatively large currents of short duration, and they must not be taken as indicating the temperatures attainable with the currents named if kept on continuously.

Fig. 2 shows the relative temperature rise on a 23/36 conductor with a given current when made up in different forms.

A further series of experiments was carried out with the same size of conductor in various finishes but with heavier currents, with a view to finding the kindling point of the insulation. The results are remarkable in that with one exception they show that the vulcanised rubber insulation actually burst into flame only when the conductor fused. This is doubtless due to the firing of the inflammable vapours by the arc following the fusion of the conductors, and it is rather an unfortunate property from a fire-risk point of view, as it may start the fire from two centres, one on the floor beneath and the other on the ceiling above. Flexibles insulated with pure rubber ignite before the wire fuses.

The persistent arcs which have already been referred to travel up these wires without flaming.

IV.—Insulation of Flexibles.

Pure Rubber Strip.—The pure rubber strip which is used for insulation purposes is prepared by two distinct methods; the raw material is the same in either case, and is first washed and dried.

In the preparation of "cut" strip the dried rubber, after being passed through compression rollers, is put through a "masticator" and then formed into blocks under considerable pressure. These blocks are frozen hard and then cut into sheets by special machinery. The process is necessarily expensive, and is only followed by a few firms in this country.

The manufacture of "spread" sheet is much simpler and less costly. The dried rubber is made into a paste or "dough" by means of a solvent, and is then spread on to a length of cloth. The solvent is then driven off by heat, leaving the rubber in the form of a sheet, which is then cut into strip.

On the Continent, owing to the cost of fine Para rubber, foreign material is added with a view to producing a cheap article which is put on the market as second or third quality sheet. "Cut" strip is generally used in this country for the innermost layer in high-class cable work, while "spread" strip is very largely used for rubber-taped flexibles, insulating tape, &c.

The "spread" sheet should, in order to have the requisite mechanical and electrical properties, be "aged" by hanging in a dark room for several months.

The strip may be artificially aged or cold vulcanised by treating the surface with a solution of chloride of sulphur in carbon bisulphide. As rubber tape is often used next to the copper conductors it is important that it should not contain sulphur. This cold vulcanised strip not only contains sulphur but nearly always contains hydrochloric acid as the result of its chemical treatment.

Pure rubber has a great affinity for oxygen, and if it is placed in direct contact with copper, the latter will part with any oxygen it has to the rubber; it is, therefore, quite necessary that the wires should be tinned, or at least covered with a close wind of cotton when in contact with pure rubber.

Absorption of Water by India-rubber.—India-rubber will absorb about 25 per cent. by weight on prolonged immersion in water, with considerable increase in volume.

Vulcanised rubber is much more homogeneous in structure than pure rubber, and the amount of water absorbed is, in consequence, very much less, but nevertheless, the fact that it does absorb water must not be ignored. Immersion tests for flexibles are required in the United States, Germany and France.

The insulation resistance after immersion in water may be taken as an indication of the amount of absorption of water by V.I.R. flexibles, but can hardly be so taken when pure rubber tape is employed, as the water may enter between the joints. A well-made pure rubber flexible will stand immersion in water without actually breaking down for a much longer period than is generally supposed.

Vulcanised Rubber.—Of all the constituents of manufactured india-rubber, none possesses such a paramount influence upon the general excellence of the product as the sulphur of vulcanisation. The amount of sulphur employed in practice varies greatly, but the amount of sulphur fixed by the india-rubber (sulphur of vulcanisation) very rarely exceeds 3 per cent. in commercial rubber articles, and is generally less. Free sulphur in various proportions always forms a constituent of ordinary vulcanised india-rubber goods. C. O. Weber states that the percentage of combined sulphur is no measure of its degree of vulcanisation, and instances the following analysis of the outer cover of a fire:—

Indiarubber	54·70 per cent.
Organic extract	1·34 ,, ,,
Sulphate of vulcanisation	1·99 ,, ,,
Free sulphur	2·88 ,, ,,
Total mineral matter	41·08 ,, ,,

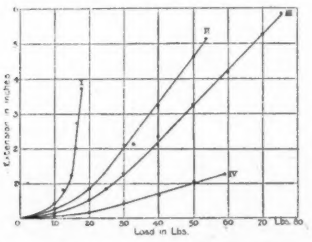


Fig. 3.—Tensile Strength of Differently Vulcanised Specimens of Para Rubber.

As the coefficient of vulcanisation is increased, the tensile strength, elasticity and distensibility are, up to a certain point, also increased; beyond this point there is first a rather rapid decrease in elasticity and distensibility, followed soon by a decrease of tensile strength. Fig. 3 (C. O. Weber) shows the elongation and tensile strength of four tire covers of absolutely identical composition as regards the quality and proportions of Para rubber, total sulphur and mineral matter, but cured under different conditions.

Of these samples I and II are under-vulcanised, III is satisfactory, while IV is over-vulcanised. It will be seen that the higher the coefficient of vulcanisation, the higher is the tensile strength for the same elongation. The results given are typical for Para rubber.

Over-vulcanisation does not consist simply of a high coefficient of vulcanisation, but in one obtained under unsuitable conditions, either of temperature, or of time, or of quantity of sulphur. Of these causes, too high a temperature is the commonest one, while too short a time is the most usual cause of under-vulcanisation. Flexibles, as a rule, are slightly under-vulcanised, as it is found that a few minutes more or less in the vulcanising chamber may make the difference between a bright or blackened conductor.

V.—Oxidation of Rubber.

Perishing due to oxidation affects the whole of the cord, and, in the author's view, puts a limit of from 10 to 12 years as the safe life of an average flexible of good quality under favourable circumstances. The use of oxidised oil, recovered rubber and other rubber substitutes will shorten the life of the flexible in proportion to the quantities of these substitutes that are present.

Recovered Rubber.—Samples containing a large percentage of recovered rubber have usually a high coefficient of vulcanisation, so that if the hysteresis loops or the elongation tests do not point to over-vulcanisation, this high coefficient may usually be taken as indicating the presence of recovered rubber.

(To be continued.)

The Driving of Reversing Rolling Mills by Electricity.

On Thursday last week, at the Iron and Steel Institute, Mr. D. Selby-Bigge read a paper on this subject. The first important note arresting the attention of one who has listened to innumerable I.E.E. papers, was the vastly amended form of procedure at the sister Institute, whose meetings were held under the roof of the mother Institution in Great George Street. The regulations governing procedure were of the most business-like character in this, their first, application. They lay down that "each paper shall be read in abstract only, ten minutes being allowed to the author for that purpose"; each speaker is limited to five minutes, excepting in each case by consent of the meeting. Speakers unable to give more than a summary of their views may amplify them in the journal. Readers of the Electrical Review will at once recognise how vastly superior this method is to that of an author reading his paper word for word, followed by verbose orations honouring the rule of short speeches by flagrant disregard.

Mr. Selby-Bigge was exceedingly concise. The Ilgner system, involving the use of fly-wheel converters and series motors controlled on the Ward-Leonard method, is familiar to electrical engineers. Its salient features are the heavy fly-wheels intermediate between the motor of the motor-generator set and the two generators. The momentary overload capacity is, of course, very greatly in excess of that of the main generators. The fly-wheel effect, which takes sudden peaks, is secured by the automatic insertion of resistance in the rotor circuit, increasing its slip and retarding its speed. The shaft of the rolling mill is directly coupled to three reversible motors, whose shafts form a continuation thereof. Three motors were selected rather than one large motor, in order to reduce the fly-wheel effect due to a revolving armature of large diameter. The only other matters calling for mention in this summary are those indicated by the four diagrams taken when rolling 18-in. girder (p. 823). The first of these is that of the motor speed, taken by a speed indicator of special construction, consisting of a small magneto-electrical machine, which recorded the changing pressure upon the terminals of the machine by means of a spark indicator. The second gives the voltage diagram of the rolling mill motors, the absolute synchronism of which with the shaft speed is very striking. The third diagram gives the current consumption of the rolling mill motors, and the fourth the resultant load upon the generating station due to fluctuations in the demands actually falling thereon. These four curves chronicle exactly what takes place during the rolling of 2-ton ingots 5 ft. 6 in. long, through the processes of cogging, roughing and finishing in the shape of 18-in. girders, an operation requiring 25 passages through the mill, and occupying about seven minutes.

Of the resultant discussion, it can be said that it was a battle between two schools, the electrical and the steam. Mr. Gledhill opened quite gently by remarking that some five years previously, in putting down a big rolling mill to deal with armour plates, he had installed a fine triple-expansion engine. It grieved him to hear that it might so speedily be obsolete. Would any of the audience bid for it? No response being forthcoming, the speaker took comfort in remarking that perhaps, after all, the economy of the Ilgner system had not been established—at any rate, he did not see it at present. The succeeding speaker had no unsettled convictions on the subject. With a type-written manuscript in his hand, he declaimed at a high pressure (about 500 words or so per minute) against electric driving. Fragments of which the brain received a recordable impression implied that electric motors were no good for rolling ingots—whereas Mr. Selby-Bigge had claimed that 20 kw.-hours were required per ton rolled, he could do the same work for 286 lb. of steam (pressure and condition unspecified). More figures followed, which, with the increasing acceleration of the speaker's flow of words, absolutely effaced their impression upon the listeners, save a final demand that the Ilgner system, to justify its use, should not only effect the rolling, but afford a surplus of 313 lb. of steam for use elsewhere.

Mr. Cooper contrasted present practice without electric driving in the three-high roll with its heavy fly-wheel, and risk of breakdown, and the steam-driving reversing rolling mill which was simple, extravagant, but not so liable to breakdown. The principle of the three-high mill was similar to the Ilgner.

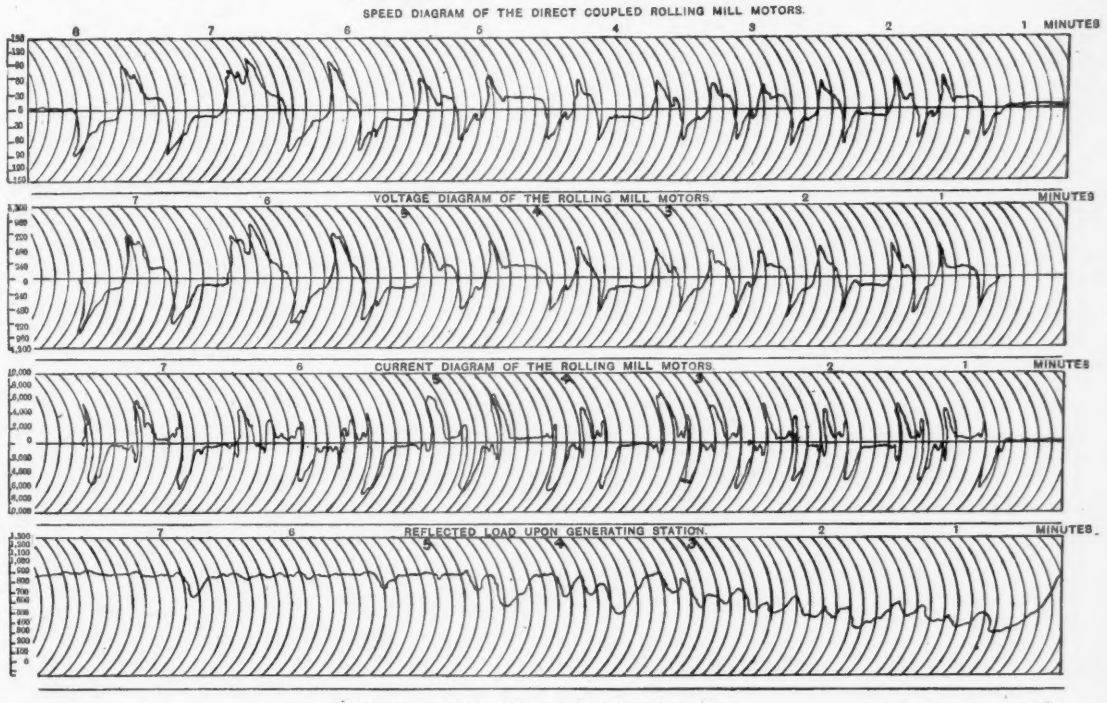
Postponing for the moment the case for electric driving as interjected from the electrical engineers present, and summarising the evidence for the attack, other speakers advanced sundry criticisms, particularly seizing upon an unfortunate remark in the paper that, with the introduction of this system into the Hildegarde Works, the number of boilers in use had been cut down from 54 to 17, without mentioning size and type. How much less coal was needed now than previously?

Mr. Tannett Walker recommended Mr. Gledhill to keep his three-cylinder engine, at any rate for the present. Another speaker

thought that steel makers would fight shy of having to pay a double cost for electric driving, as it would cost £30,000 to install such a system, independent of the mill, a sum double that required for a steam-engine of the same duty. As regarded speed regulation, the steam engine was superior. For the rest, the author came in for some drastic, and, perhaps, deserved criticism for the manner in which certain of his claims were loosely worded. Thus, "Sixthly.—Absolute control over rolling mill costs and power absorbed at any stage of all rolling operations by the use of electric recording and automatic instruments." It was pointed out that an exact record, and control (in the sense of power of regulation), were different things. Worse still, a claim of reduction of power by the Ilgner system was untenable. The total power actually required at the rolls must be the same, but the rate at which this power would be delivered from the main station would be profoundly modified. Finally, the suggestion that "several subsidiary advantages may become apparent" was attacked as visionary, and inherent but not immediately apparent di-advantages were hinted at.

For the defence, which was fairly evenly interweaved with the attack, it was pointed out that the Ilgner system equalised the power output, and rendered an intermittent demand for power continuous. Mr. Robert Hammond urged that the load factor was the dominant item, and asked how the fuel consumption in the installation described compared with the outlay in other cases; it was also necessary to know the capital outlay and cost of depreciation. In designing these installations with fly-wheel reserves, it was essential that the peak loads should be of short duration. Also, as an electrical engineer, he did not like liquid resistances, and asked

DIAGRAMS TAKEN WHEN ROLLING 18-INCH GIRDERS.


SPEED DIAGRAM OF THE DIRECT COUPLED ROLLING MILL MOTORS.
MINUTES
VOLTAGE DIAGRAM OF THE ROLLING MILL MOTORS.
MINUTES
CURRENT DIAGRAM OF THE ROLLING MILL MOTORS.
MINUTES
REFLECTED LOAD UPON GENERATING STATION.
MINUTES

DIAGRAMS READ FROM RIGHT HAND SIDE.

for a D.C. motor in the middle of the motor-generator equipment in place of the three-phase motor. Another speaker confessed that the paper appealed to him very forcibly as indicating the right direction. They might sit there all day and talk about pounds of steam, but that was futility. Mill stoppages were inherent in all steam works. It was all a question of load factor, and the local circumstances of how many mills, how grouped, how equipped, and how loaded. Cogging mills were idle for hours in each day. A central power station with its improved load factor must certainly supersede isolated engines.

Mr. C. H. Merz said that the Ilgner system was not "an electrician's job," but a thoroughly mechanical affair, and disagreed with Mr. Hammond's aversion from liquid resistance controllers. Reviewing the points at issue, he said that two questions arose. First, was there any economy or advantage in electricity *per se* for driving rolling mills? Quite apart from possibilities of steam saving, they must remember what the electric motor had achieved in accelerating trains. Secondly, as to the cost of the power itself, the Ilgner system was merely a leveller of power, and improved the load factor. Of all studies to be commended to the manufacturers, that of an equalised load factor was the most important.

Finally, Mr. D. Selby-Bigge asked leave to defer his detailed reply. He recognised the incompleteness of his paper upon the subject of costs, but he was not in a position to communicate these details until they had been presented to a German institution. At the forthcoming autumn meeting of the Iron and Steel Institute in Vienna, members would have an opportunity of seeing an installation, and he would then supplement the present paper by another dealing fully with these and other facts.

THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

An Improvement in the Financial Results.

The fact that most of the electrical engineering companies in Germany are able to show improved financial results for 1906, at all events in so far as the annual reports and balance-sheets have been published down to the present time, indicates that the trade of that country, when regarded as a whole, was in a flourishing condition during the year. It is impossible to say definitely whether the development is due solely to the demands of the inland market, or whether the export trade has also participated in the progress, although it is probable that the home trade is responsible for the major portion of the increased turnover on account of the general industrial prosperity.

The other principal countries on the Continent also appear to have shared in the favourable course of international trade. Several of them have new treaties of commerce in operation, and under these the duties on the imports of electrical machinery and apparatus are higher than those obtaining under the old *régime*. As these treaties only came into force in March of last year, it will be obvious that the period down to the end of 1906 is too short to allow of any conclusions being drawn as to the effects which they may have had, either in assisting in the development of native industries in the countries concerned, or in checking imports of machinery and plant from competitive nations, and notably Germany. In fact, a year or two must necessarily elapse before any correct comparisons can be made, or any definite conclusions arrived at on the subject.

German Companies.

The directors of the Hartmann & Braun Co., of Frankfort-on-Main, state in their annual report that the considerable increase in orders which characterised the opening of 1906 continued throughout the year. As compared with 1905, the value of the turnover in electrical measuring apparatus last year advanced by 30 per cent., and several new types were placed upon the market. The financial results are as follows for the past two years:—

	1906.	1905.
Share capital	£85,000	£85,000
Loan capital	43,000	—
Gross profits	76,448	59,630
Depreciation	14,985	8,371
Net profits	25,698	20,493
Dividend, per cent.	12	10

The company now possesses 350 patents, trade marks, &c., although the patent account has been entirely written off. The inventive activity in the laboratories proved to be fruitful, but the briskness of business compelled the postponement of its utilisation to some extent. As in former years, the directors again complain of the insufficient advent of well-trained mechanics. An attempt is being made to overcome the difficulty by the training of

pupils in the instruction shops which the company first established in 1905 specially for this purpose, and 20 pupils are now undergoing methodical instruction. The report adds that the present year has witnessed a further augmentation in orders, and the company is now under the necessity of increasing prices by 5 per cent. owing to the rise in raw materials. It is also essential for extensions of the works to be made in order to manufacture on a more rational basis, and the hope is expressed that these will be of advantage even if, as many apprehend, an economic depression should take place in the near future.

The Bergmann Electricity Works Co., of Berlin, is gradually developing into an extensive undertaking from the points of view represented by share capital, volume of business and remunerativeness. In 1904 the share capital reached £425,000, in 1905 £500,000, and in 1906 £700,000, whilst in the present year a further increase to £900,000 is taking place; and the dividend in the three years mentioned has been 18 per cent. According to the directors' report for 1906, it was only possible to meet the requirements of customers by in part working night shifts, and many transactions had to be declined owing to the short period stipulated for delivery. The latter difficulty has now been overcome by the starting of a new works. The value of the turnover last year was £800,000, as compared with £660,500 in 1905 and £535,500 in 1904. The accounts show the undernoted figures for the past two years:—

	1906.	1905.
Share capital	£700,000	£500,000
Depreciation provision ...	66,455	50,794
Net profits	115,226	105,380
Dividend, per cent.	18	18

The share capital paid up at the end of 1906 was £558,500, and the amount participating in the dividend is £500,000. The report states that the machine department again favourably developed, especially for large machines, and owing to the good prospects for steam turbines, an additional shop is to be built. At present high-pressure steam turbines on the Rateau system are being constructed up to an output of 4,000 H.P. The installation material branch has made good progress, the meter department was started in May of last year, and the manufacture of metallic filament lamps has been undertaken, whilst a site has been obtained for the erection of metal works to meet the needs in respect of copper and brass manufactures. The increase in the French Customs duties has induced the company to form the Société des Usines Electriques Bergmann for manufacturing in France, and a factory for the purpose has been rented in Paris. The report adds that the degree of employment was never better than it is at present, the quantity of orders at the beginning of the current year was twice that obtaining at the opening of 1906, and orders have continued to arrive in satisfactory numbers.

The report of the Deutsche Kabelwerke Gesellschaft (German Cable Works Co.) of Rummelsburg, near Berlin, shows that the net profits realised in 1906 amounted to £23,744, after writing off £3,307 for depreciation, as compared with £8,976 and £2,096 respectively, in the period of seven months composing the preceding financial year. It is proposed to pay a dividend of 7 per cent., as contrasted with a distribution at the same rate per annum for the seven months of 1905, to appropriate £9,000 for the purpose of additional depreciation, as against £3,500, and to carry the balance forward. The share capital amounts to £175,000, and represents an increase of £75,000 over 1905. The additional capital participates to the extent of one-half of the dividend for the past year. The report states that a further satisfactory development took place in the business of the Union Cable Co., that the Rummelsburg Works are briskly employed, and that the orders in the current year indicate a considerable increase over the same period of 1906.

The report of the Mix & Genest Telephone and Telegraph Works Co., of Berlin, points out that the disproportion between sales and profits, which still continued during 1905, was largely surmounted in 1906 as a consequence of the agreement arrived at between the influential firms in regard to the raising of prices. It is expected that the new works will soon be finished, so that the transfer will be able to take place late in the summer, and a material improvement in the economic position of the undertaking is expected to result from the consolidation of all the manufacturing branches. The accounts show profits amounting to £43,350, as compared with £32,756 in 1905. After making provision for depreciation to the extent of £10,952, as against £10,258 in 1905, the balance allows of the payment of a dividend of 9 per cent. on the capital of £250,000, as contrasted with 8 per cent. in the preceding year. The current year has, so far, answered expectations, although a hampering influence is now beginning to make itself felt, owing to the operation of the new treaties of commerce. Steps are, however, being taken in the direction of the transformation of these foreign businesses, in order to prevent the disadvantageous effects of the higher import duties.

The Suddeutsche Kabelwerke (South German Cable Works Co.) Gesellschaft, of Mannheim, realised in 1906 the good results which the directors had expected. In the course of their report it is mentioned that the volume of business was materially greater than in the preceding year, and the plant was well and uniformly employed. The company had to contend with considerable increases in the prices of raw materials and of wages, but the rates for manufactures were frequently not able to respond to an equivalent extent. The accounts indicate net profits of £29,572, as compared with £23,458 in 1905, and a dividend has been declared at the rate of 8 per cent. on a capital of £150,000, as contrasted with 7½ per cent. on £120,000 in 1905. The future is said to depend upon developments in the general course of business, the price movements of raw materials and manufactures and the condition of the money market.

(To be concluded.)

A MODERN SHIP-LIGHTING INSTALLATION.

ONE of the most recent additions to the fleet of the British India Steam Navigation Co. is the ss. *Rohilla*, built by Messrs. Harland and Wolff. This ship is provided with a very complete electric light installation, which was fitted by Messrs. J. H. Holmes & Co., of Newcastle-on-Tyne, to whom we are indebted for the following interesting details.

The generating plants, of which there are two, are fixed one on each side of the engine room, at the after end of the starting platform; each consists of a Paul compound high-speed engine rated at 100 B.H.P. (100 lb. steam pressure) at 450 R.P.M., and coupled to a Holmes multipolar generator having an output of 685 amperes at 100 volts pressure.

The main switchboard is fixed about midway between the two generating plants and is supported on stout angle-iron uprights, fixed 2 ft. 6 in. from the bulkhead.

The panels are of enamelled slate mounted in a teak frame; the generator switchgear includes two marine-type voltmeters and ammeters, two D.P. 700-ampere main switches and D.P. fuses, and the circuit switches, 13 in number, are of the 100-ampere change-over chopper type, so arranged that any circuit can be run from either machine.

The installation, which is carried out on the double-wire system, comprises 715 16-C.P. lamps; 69 12-in. bracket-type fans, one being fixed in each state-room; 18 ceiling type fans, with blades of 36-in. sweep, which are fixed in the saloons, smoke rooms and public rooms; 5 2½-H.P. Holmes motors, each driving a Sirocco fan for ventilating the passengers' accommodation, state rooms and the different 'tween deck spaces, which latter are fitted up for the carrying of troops.

The lighting of the ship is divided up into ten circuits at the main switchboard, and includes a police circuit and a day light circuit; the cabin fans are on an entirely separate circuit from the lighting. The motors for driving the ventilating fans are also on two separate circuits.

The wiring of the vessel is carried out on the "distribution box" system. A pair of mains are run from each separate circuit-switch on the main switchboard, to a section box fitted with D.P. fuses and S.P. switches. The branch circuits are further subdivided by running a pair of mains from each of the D.P. fuses on the section board to a sub-section D.P. fuse-box, for sub-dividing the lights into groups of not more than six lamps, fed through special connection boxes.

The distribution fuse-boxes fixed in the passengers' accommodation and officers' quarters, are enclosed in polished teak cases with glazed fronts; those fixed in the engine and boiler rooms, exposed positions and 'tween decks, are enclosed in cast-iron cases with hinged water-tight doors, the boxes being lined with asbestos. All the fuses are of the porcelain bridge type.

The cable used throughout the ship is 1,200 megohm quality. The mains and sub-mains are lead-covered, armoured and braided overall. The cables, on leaving the engine room, to run forward and aft through the 'tween decks, are further protected by encasing in steel troughing, arranged with a removable cover, so as to be easily accessible, and to meet the Admiralty requirements in the event of the vessel being chartered for the carrying of troops.

The branch wiring throughout the passenger accommodation and officers' quarters consists of 7/23 twin wires, heavily lead-covered, and is neatly clipped up to the decks or panelling with brass clips and screws.

For branch wiring in the engine and boiler rooms and other machinery spaces, including crew's quarters and 'tween decks lighting, 7/23 twin wires, lead-covered, armoured and braided overall are used, clipped up to the underside of the decks or steel casings with steel saddles, and fastened with brass-tapped screws.

The 'tween decks are specially fitted out to meet the Admiralty requirements, in the event of the vessel being chartered to carry troops, and are exceptionally well lighted, some 150 lights being fixed. The fittings are substantial, of the flat back type in cast-brass and made portable, the flexible cables being protected by metallic steel tubing. The socket connections are fixed on the side of the beams close up to the deck and near the hull of the ship, so that when the vessel is not carrying troops the fittings can be detached and stowed away.

An electric bell installation, comprising 108 pushes, is fitted in the first-class accommodation, and rings to indicators fixed in the pantries and smoke rooms.

Royal Institution.—At the Royal Institution on Friday last, MESSRS. JOHNSON, MATTHEY & CO., LTD., exhibited specimens of their iridium and rhodium basins, tubes, &c.; they have succeeded in producing these metals, hitherto practically unworkable, of such extreme purity as to enable them to be used for the manufacture of such apparatus, which have a very high melting point, and are almost unattacked by acids. The firm also showed apparatus of fused silica made by an English firm.

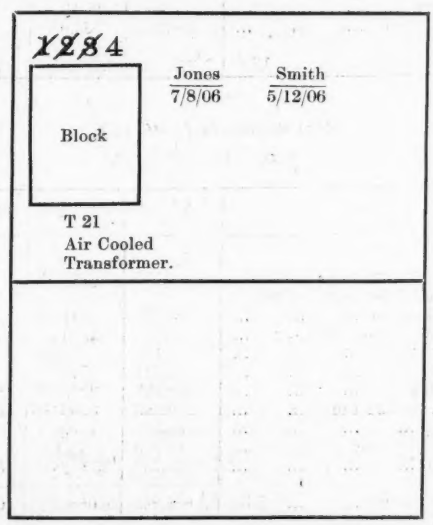
PUBLICITY: ANOTHER POINT OF VIEW.

[COMMUNICATED.]

(*Continued from page* 709.)

THE question of making blocks is a very important one, as we have already shown, and the manager of a publicity department should have some artistic knowledge in order to arrange his illustrations suitably. Most large firms employ a photographer of their own, or, at least, have someone in their employ who can take photographs, although this is not always the same thing. If this person can be attached to the publicity department so much the better, as the firm's goods can be then always photographed with the ulterior object of process reproduction. For this and general advertising purposes, every standard article and every special article should be photographed, and good prints kept in a slip-mount album and properly registered. Those prints for which there is likely to be a demand may be stocked in quantities and filed in a suitable manner, being printed on blue, dekko or silver paper as required. When it is intended to make a block from a photo, the latter should be carefully examined in order to ascertain what part, if any, can with advantage be cut out, and where retouching or spotting-out is required, in order to show the article or view in question to best advantage. No rules can be laid down in this connection; the publicity man must learn by experience how to make the best kind of block from a photo.

The keeping of blocks is no less important than their making. As blocks accumulate, if they are not kept in a methodical manner, confusion soon reigns supreme. For this purpose again, a ledger is of little use; something more elastic is required, so that a block may be found at once. Sometimes the card system is invoked, but as no system is of much use unless the illustrations are shown, the card system is limited if the blocks attain any great size. Further, it is only possible to look at one card at a time. The writer has found that the most comprehensive system is to divide the blocks up into classes according to the firm's manufactures, and to number the blocks consecutively (as they are made) placing a class index letter against each number,



and keeping a guard-book for each class. For instance, all blocks of tranformers might be numbered T1 and upwards; these would go in a separate set of drawers, and the guard-book would be labelled "Transformer Blocks." As each block is received, an impression is pasted in the book with a few square inches of space for the necessary endorsements. These should consist of title, block number and quantity of blocks of the same kind. If a duplicate block is made the first number is crossed out, and the number 2 added. When the block is sent to a printer, or elsewhere, this can be noted with the date of loan; when the block is returned the endorsement is merely crossed out. It is thus possible to see at a glance how many copies of each block are out, and where they are. The accompanying sketch indicates how a page in the guard-book may appear, and shows that two of the four blocks are out, and where they are. The best method of numbering blocks is to use a punch and mark them on the side. Labels stuck on the back either come off or are pasted over by the printer's "packings." Whenever a block is sent away, an advice and receipt note should be sent with it. When the latter is returned duly signed, it should be pasted on the advice note-book, so that it is a permanent record of the receipt of the block. Some firms find it necessary to lend many of their blocks to retail customers and others for use in price lists; in fact, they maintain a large floating stock of blocks, and if a sharp eye is not kept on these, considerable expense may be involved. A whip-round may be posted at monthly intervals for the return of blocks on loan; another method is to debit all blocks to the borrowers, and to credit them when returned. The latter method has two disadvantages; it militates against the borrowing of blocks, and so against free advertising; it also conduces to an unnecessary amount of book-keeping. The more facilities that are given for the loan of blocks, the more widely will the firm's goods be known.

A publicity department manager has to know how to draw up good Press notices and articles. He will find his personal acquaintance with the Press of considerable value in this connection, but he must not presume upon this by overdoing the Press notice business, even if he is an advertiser. No amount of advertisements will make it worth an editor's while to insert too many trivial notices about the firm's doings. In some quarters this is almost overdone now, and readers are not all interested in these matters. The art of writing Press notices is to make a readable paragraph or article on something of real interest, and to weave in the advertisement in a not too ostentatious manner. Blatant and vulgar announcements and the use of grandiloquent epithets, with verbose trumpetings, only defeat their end, if they even manage to pass the editorial blue pencil. Press notices should always, if possible, be illustrated. If they are sent to more than one paper, it is as well to word them differently, to send different illustrations, and to let the editors know this; they will be more ready to insert the notice or article, if they feel that they have something exclusive. For this reason carbon copies are better kept in the office; they "give the show away." A good technical journal will generally be found ready to send its representative to obtain particulars of any really interesting engineering job at its own expense, if it has the exclusive rights of first publication. Press journeys *en bloc* are usually a mistake, because no editor gives the some amount of attention to a subject that he knows all his competitors will treat of. But if such journeys are organised, all information, photos, drawings, &c., should be ready beforehand; and the tyro should remember that pressmen's first-class fares and meals should be paid for.

(*To be concluded.*)

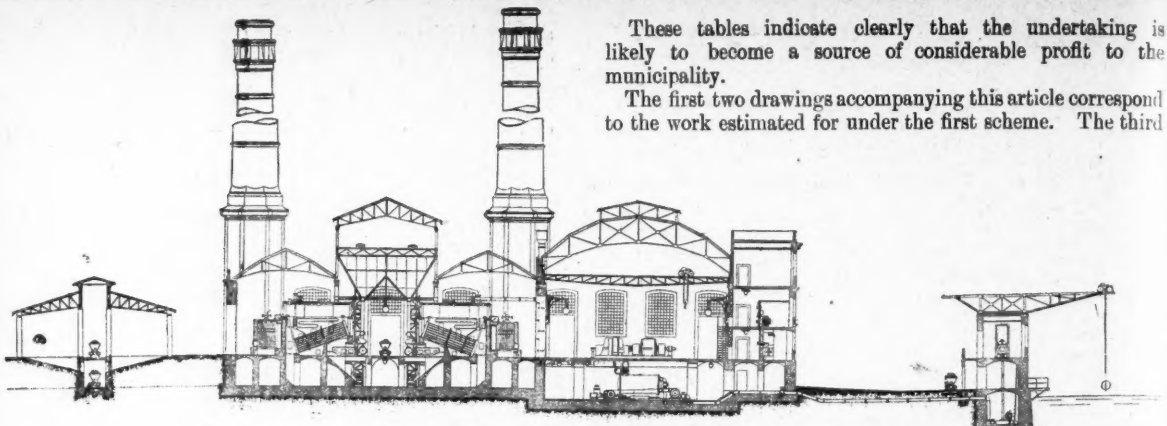
THE MUNICIPAL ELECTRICAL INSTALLATION OF ROME.*

IT is well-known that Rome is supplied with electricity for lighting and power purposes by the Anglo-Roman Company for the Illumination of Rome with Gas or Other Systems. The prices have, however, always been considered somewhat high, besides which there are many side streets that have not been dealt with at all, and some new parts of the town are not touched by the company.

The Technological Office of the City of Rome has, therefore, proposed a municipal electrical undertaking, some particulars of which we think will interest our readers.

The municipal project is composed of three schemes; the first scheme provides a steam generating station with three units each of 1,500 KW., two of which might be at work with the third in reserve, for the purposes of lighting all the streets and squares actually lighted at present with petroleum or gas, together with a network for private distribution in the zone which is not yet served by the Company, the selling price being fixed at 35 centimes per KW.-hour for lighting, and 15 centimes per KW.-hour for power.

* From *L'Ingegneria Ferroviaria.*



Cross Section through the Proposed Municipal Power Station, Rome.

The second scheme provides generating plant for three 1,500-KW. sets, as above, plus two 3,000 KW. sets capable of dealing with a maximum load at any time of 7,000 KW. with ample reserve; this would deal with two-thirds of the supply now derived from the Gas Company, and would also supply power for the additional tramways which are projected for the City, the price for the latter being fixed at 7 centimes per KW.-hour measured as three-phase current.

The third scheme provides for a central station with 28,000-KW. of steam plant installed, 24,000 of which might be reckoned for providing the maximum load with 4,000 in reserve, together with a hydro-electrical installation which would be capable of delivering 10,000 KW. to the City. This scheme is proportioned for lighting a City of a million inhabitants with 350 KM. of streets and supplying an electric traction system with 500 cars. The energy would be generated and distributed on the three-phase system.

The price under this scheme would be 15 centimes per KW.-hour for lighting, and from 80 to 120 lire per year per H.P., or 10 centimes per KW.-hour for power.

The principal figures composing the estimates are given in the following table :—

TABLE I.

—	Scheme 1.	Scheme 2.	Scheme 3.
	Lire	Lire	Lire
1. Ground and cost of transfer	105,000	105 000	
2. Building work	340,000	4! 0 000	
3. Boilers and accessories ...	350,000	800,000	
4. Turbo-generators and accessories	550,000	1,430,000	8,080,000
5. Switchboards and accessories	45,000	78,000	
6. Office, test room, meter equipments	90,000	165,000	
7. Primary network	480,000	880,000	3,000 000
8. Transformer stations ...	190,000	530,000	2,000 000
9. Secondary network ...	1,025,000	2,115,000	5,000,000
10. Illuminating apparatus ...	180,000	520,000	1,500,000
11. General expenses and unforeseen	250,000	597,000	2,120 000
12. Working capital	1,000,000	1,800,000	8,300,000
13. Cost of hydro-electric installation	—	—	8,000,000
Total Lire	4,605,000	9,500,000	38,000,000

TABLE II.—Output.

—	Maximum demand in KW.			Annual consumption in KW.-hours (thousands).		
Scheme ..	1	2	3	1	2	3
Public lighting	310	1,045	2,500	880	3,100	6,600
Private lighting	1,110	3,370	16,000	1,340	4,950	18,700
Motive power ...	320	800	7,000	1,200	3,100	29,000
Power for tramways	—	1,075	5,000	—	5,000	17,000
Losses	260	710	2,500	980	2,160	8,700
Totals	2,000	7,000	34,000	4,400	18,310	80,000

These tables indicate clearly that the undertaking is likely to become a source of considerable profit to the municipality.

The first two drawings accompanying this article correspond to the work estimated for under the first scheme. The third drawing shows the complete power station for Scheme 3.

In the large modern stations built outside the city on suitable sites with ample water for condensing purposes, distributing by means of transformer sub-stations with secondary networks, and using steam turbines and large boilers automatically stoked, immense economies have been obtained, labour charges are reduced to a minimum, and capital costs can be brought down to 300 lire per KW. installed. The cost of the network is diminished in almost the same proportion by using high voltage with the three-phase system and the advantages now offered in systems of distribution. The combination of steam and water-driven electric plants also adds to economical working, the latter being able to take the all-day load, whilst the former can be drawn on at the times of extra heavy load. All these considerations will, it is thought, effect a notable reduction in the cost of production.

As regards the schemes previously referred to, the water-tube boilers will work in conjunction with economisers,

TABLE III.—Balance Sheet.

Revenue.

—	Scheme 1.	Scheme 2.	Scheme 3.
Expenses saved by lighting with electricity instead of gas, petroleum, &c.	Lire 411,243	Lire 1,183,000	Lire 2,100,000
Expenses saved for lighting public buildings	123,000	135,000	300,000
Expenses saved for motive power	150,000	140,000	700,000
Revenue from private lighting	399,000	1,410,000	2,700,000
Revenue from motive power ...	105,000	360,000	1,500,000
Revenue from tramways ...	—	350,000	1,200,000
Meter rents and installation charges	135,000	260,000	1,550,000
Other sources	100,000	230,000	400,000
Totals ... ... Lire	1,423,243	4,068,000	10,450,000

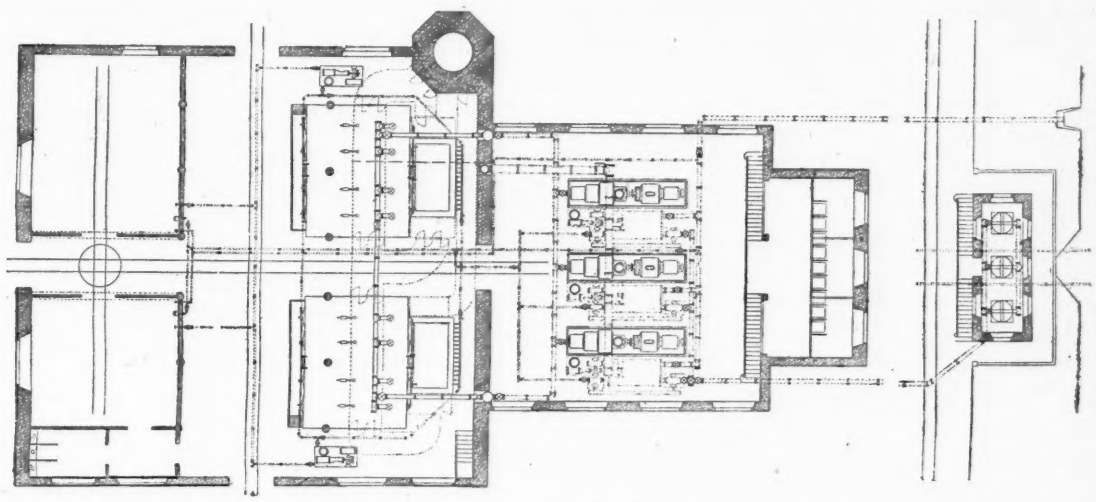
Balance Sheet *(continued)*.

Working Expenditure.

—	Scheme 1.	Scheme 2.	Scheme 3.
	Lire	Lire	Lire
Coal and other combustibles ...	213,600	792,000	860,000
Hydro-electric standing charges	—	—	110,000
General expenses	128,200	298,600	585,000
Street works repairs	46,700	123,000	220,000
Internal repairs...	6,100	7,600	20,000
Maintenance	44,471	82,000	500,000
Depreciation	131,775	310,000	1,000,000
Capital sinking fund	179,595	370,500	1,330,000
Taxes	50,550	105,000	300,000
Sundry expenses	80,000	98,300	320,000
Balance	514,352	1,181,000	5,205,000
Totals ... ... Lire	1,423,243	4,068,000	10,450,000

superheaters and automatic stokers, producing steam at a pressure of fourteen atmospheres. The first installation would include two batteries each of two boilers, any one capable of producing 8,500 k.g. of steam per hour, burning about 1,200 k.g. of coal. The steam-piping is to be of steel covered with asbestos non-conducting material, and will be run in a channel under the floor with suitable covering plates.

The switchboard will be in two galleries, divided up into separate compartments, each containing interchangeable apparatus, and each one independent of the other. In the construction neither wood nor marble is to be used,



Plan of the First Section of the Proposed Municipal Power Station, Rome.

and the exposed parts and the levers are to be metallic and connected to earth.

The lower gallery will contain the feeder switchgear, with measuring and registering instruments, and with switches operated by motors.

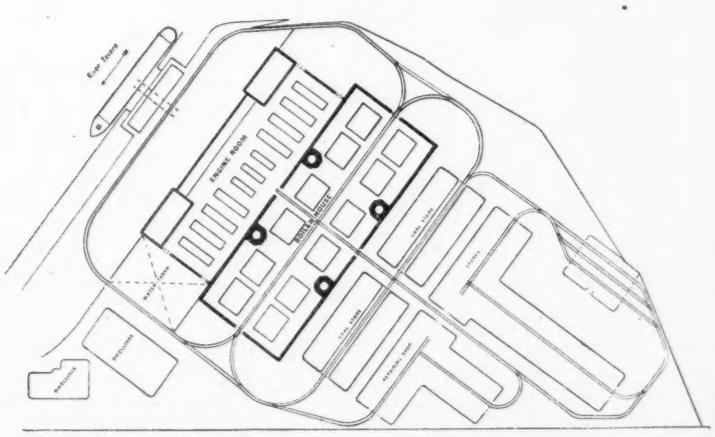
The upper gallery will be devoted to the generator switchgear.

The system of distribution has been settled as three-phase at 6,000 volts, with static transformers reducing the pressure to 220 volts between phases, or 130 volts from any phase to the neutral conductor. It is intended to use four cables for the secondary network.

The primary network leaving the station will consist of four feeders. The latter are designed so that the average loss during full load will not exceed 3 per cent., and are of a sufficient section to permit of three carrying the load should one break down; and, by means of switchgear suitably housed along the run of the feeders, it is possible to cut out and interchange sections of the feeders.

The secondary network will be constructed in distinct zones, which can be worked independently or connected up together. Hand regulation will provide for varying the pressure in accordance with the load, so that constant pressure may be maintained at the points of consumption. The technical office of the city has allowed ample margin in making the calculations for all legitimate charges and has made reasonable provision for contingencies.

The Common Councillors of Rome have unanimously approved the project.



Key Plan of Complete Municipal Power Station, Proposed for Rome.

Will.—The estate of the late Mr. George Herring has been sworn at £1,371,153 gross.

Lap-Welded Boilers.—An explosion has recently taken place in Massachusetts which is attributed to a lap-welded boiler seam. A statement is made in *Power* that 60 per cent. of the boilers in the East, by which we believe are meant the New England States, are of the lap-welded type. No doubt the idea of welded boiler seams is seductive. So much material and labour can be saved by welding the edges of two plates, which must otherwise be joined by a butt cover strap, fixed by many rivets in laboriously drilled holes, with the result that with an addition of a considerable percentage to the weight of the boiler, about as large a percentage of the strength of the solid plate must be sacrificed. Now in a *perfect* weld there is no increase of weight, and there is little loss of strength, but who is to guarantee the perfect weld? Steel is at best a material which is by no means readily weldable. It can be excellently welded for the purposes of furnaces under compressive stress, but even a couple of bricks laid together with a rubbing of sand between them will carry a load, and yet not bear tension. We believe there are no high-pressure boilers in Great Britain which depend on the tensile strength of welds for their safety. Two other comparatively recent American boiler explosions are also said to have been due to lap-welded shells. We should not put faith even in welded wrought-iron, though this can be welded more certainly than can steel. But even if a weld can be made good and sound, can it be imagined that in the stress of the workshop every weld is likely to be so? The welding smith might suspect a doubtful weld, and hesitate to declare its nature, and it would pass on. Safety in such things should hardly be left to chance in commercial engineering. With rivets and modern methods of rapid boiler building, boiler shell plates are all drilled together. They go together truly for riveting, and can hardly get wrong. Riveting is comparatively slow work and errors would show up during progress, and a bad joint might have but little less than its proper strength. A riveted joint, in fact, can to-day be relied on to be near its expected strength. A welded boiler plate may stand for years, and finally fail because the sound fraction of the weld has become partly corroded away. It may stand for years and not fail under the usually foolish hydraulic test and then some day it will disastrously give way. No economy of construction will as yet warrant the use of a welded longitudinal seam in a boiler shell, even when of small diameter.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

9,865. "Improvements in or relating to tremblers of induction-coils." The Electric Ignition Co., Ltd., and F. H. Hall. April 29th.

9,866. "Improvements in and relating to speed-regulating devices for electric motor starters, and the like." H. A. Louks and H. G. Newman. April 29th.

9,868. "Improvements in or relating to electro-magnetic circuit breakers." The Electric and Ordnance Accessories Co., Ltd., and R. F. Hall. April 29th.

9,874. "Improvements in electric travelling pulley blocks or hoists." J. Holt, trading as Holt & Willetts. April 29th.

9,892. "Electric indicator—both visible and audible—of the condition of railway signals in fog or storm." W. J. Luxton. April 29th.

9,921. "Improvements in electric water-heaters." J. T. Howell. (Date applied for under Patents Act, 1901, May 7th, 1906, being date of application in United States.) April 29th. (Complete.)

9,923. "Improvements in electrical impulse counting switches." H. J. Roberts. April 29th. (Complete.)

9,950. "Improvements in or relating to the operation or control of alternating electric current generators and of motors supplied therewith." H. A. Mavor and Mavor & Coulson, Ltd. April 29th.

9,962. "Improvements in and relating to electrically-operated signals." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 29th.

9,963. "Improvements in and relating to electrically-operated signals." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 29th.

9,991. "Multiple sockets for incandescent lamps." E. L. Elliott. (Date applied for under Patents Act, 1901, May 18th, 1906, being date of application in United States.) April 30th. (Complete.)

10,001. "Improvements in or relating to automatic railway signalling and train controlling apparatus." R. S. Kitson and W. Kellett. April 30th.

10,006. "Switch gas lighter." A. T. Pendrill. April 30th.

10,007. "Improved method of and means for altering the working speed of polyphase motors." Siemens Bros.' Dynamo Works, Ltd., and H. B. Poynder. April 30th.

10,040. "Improvements in arc lamps." J. P. Gallois. (Date applied for under Patents Act, 1901, May 2nd, 1906, being date of application in France.) April 30th. (Complete.)

10,071. "Improvements in supports for the filaments of incandescent electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 30th.

10,072. "Improvements in electric motor control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 30th.

10,091. "Improvements in electric telegraph apparatus." W. Sutcliffe. May 1st.

10,115. "Improvements in devices for closing or covering the slots or openings of the conduits of electric tramways or the like." W. S. G. Blake. May 1st.

10,119. "Improvements in and in apparatus for controlling electric cooking and heating apparatus and the like, and indicating when they are in use." G. M. Newbery and The British Prometheus Co., Ltd. May 1st. (Complete.)

10,120. "Improvement in and relating to a time limit electric fusible cut-out." R. Holden. May 1st.

10,126. "Improvements in systems of electrical distribution by means of vapour electric apparatus." P. H. Thomas. (Date applied for under Patents Act, 1901, May 5th, 1906, being date of application in United States.) May 1st. (Complete.)

10,136. "Interrupter for magneto-electric ignition apparatus." G. A. Unterberg and F. Helmle, trading as the firm of Unterberg & Helmle. (Date applied for under Patents Act, 1901, August 11th, 1906, being date of application in Germany.) May 1st. (Complete.)

10,142. "Improved dynamo-electric coupling." H. Hobel. May 1st. (Complete.)

10,152. "Improvements relating to conversation counters in telephone exchanges." Siemens & Halske Akt.-Ges. (Date applied for under Patents Act, 1901, May 3rd, 1906, being date of application in Germany.) May 1st. (Complete.)

10,126. "Improvements in electric heaters." H. Leitner. May 1st.

10,171. "Improvements in and relating to controlling devices for electrically-operated winding engines." Allgemeine Elektricitats-Ges. (Date applied for under Patents Act, 1901, May 2nd, 1906, being date of application in Germany.) May 1st. (Ccmplete.)

10,172. "Improvements in electric signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 1st.

10,230. "Improvements in methods of and apparatus for refining tin electrolytically, particularly for extracting pure tin from alloys, wastages, residues, and the like, with the extraction of the foreign metals." O. Steiner. (Date applied for under Patents Act, 1901, February 1st, 1907, being date of application in Germany.) May 2nd. (Complete.)

10,259. "Improvements in or relating to wireless telegraphy." F. W. Le Tall. (P. C. Hewitt, United States.) May 2nd.

10,270. "Improvements in and appertaining to ships' telegraphs and the like." R. H. Dougan and A. W. Bibby. May 3rd.

10,293. "Improvements in or relating to the trolley heads of electric tramcars and the like." C. W. Collins, W. J. Hayes and F. W. Watson. May 3rd.

10,303. "Combined magneto platform and engine hanger." T. Silver. May 3rd.

10,306. "Improvements in or relating to telephone systems." R. L. Murray and F. T. Jackson. May 3rd. (Complete.)

10,328. "Method of and apparatus for determining the position of an object or the like which has been detected with the aid of Rontgen rays." J. Gillet. (Date applied for under Patents Act, 1901, May 4th, 1906, being date of application in Germany.) May 3rd. (Complete.)

10,356. "Improvements in and relating to electrical commutator machines." W. G. Schmidt. (Date applied for under Patents Act, 1901, May 3rd, 1906, being date of application in Germany.) May 3rd. (Complete.)

10,367. "Improvements in the electro-deposition of iron." S. O. Cowper-Coles. May 3rd.

10,369. "Improvements in dynamo-electric machines." Ateliers Thomson-Houston (Anciens Etablissements Postel-Vinay.) (Date applied for under Patents Act, 1901, May 10th, 1906, being date of application in France.) May 3rd. (Complete.)

10,391. "Electro-magnetic coupling, driving and speed-varying device." R. R. Steel and R. L. Hattersley. May 4th.

10,406. "Improvements in junction boxes for electrical cables." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols.

10,431. "Improvements relating to single-line intercommunication telephone systems." I. B. Birnbaum and H. G. White. May 4th. (Complete.)

10,440. "Improvements in microphones for telephones." R. C. Browne. May 4th. (Complete.)

10,450. "Improvements in and relating to electric resistances." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 4th.

10,451. "Improvements in and relating to electric motor control and apparatus therefor." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 4th.

10,452. "Improvements in and relating to systems of electric traction." Allgemeine Elektricitats-Ges. (Date applied for under Patents Act, 1901, May 4th, 1906, being date of application in Germany.) May 4th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1906.

Cooling and Ventilating of Dynamo-Electric Machines. H. Chitty. 8,430 April 7th.

Electric Glow Lamps and the Manufacture of Same. P. M. Justice. (Deutsche Gasgluhlicht Akt.-Ges. (Euerges.) 8,499. April 9th.

Starters and Regulators for Electro-Motors. Johnson & Phillips, Ltd., P. J. Tunley and L. Burn. 8,528. April 9th.

Electrically-Wound Clocks. J. M. Tourtel and H. Hatfield. 8,605. April 10th.

Electric Telegraphy. A. E. Baronio, A. Muirhead and R. A. Edgar. 8,787. April 11th.

Electrically-Operated Apparatus Suitable for Making and Breaking Electric Circuits and as a Motor. E. W. Steljes. 8,891. April 12th.

Electric Controllers. British Thomson-Houston Co. (General Electric Co.) 8,935. April 12th.

Selective Signalling Mechanism. W. Fairweather. (International Telegraphic Call Co.) 9,068. April 17th.

Cooling or Ventilation of Dynamo-Electric Machines and the like. H. Chitty. 9,090. April 17th.

Switches for Use with the Transmitters and Receivers of Electrical Signalling Apparatus. A. T. Dawson and G. T. Buckham. 9,348. April 20th.

Space Telegraphy. J. S. Stone. 9,781. April 26th. (Date applied for under International Convention, June 20th, 1905.)

Space Telegraphy. J. S. Stone. 9,788. April 26th. (Date applied for under International Convention, June 20th, 1905.)

Brushes for Dynamo-Electric Machinery. Morgan Crucible Co. and C. W. Speirs. 9,794. April 26th.

Current Distributing Devices for Effecting the Ignition in Explosion Engines. H. de la Valette. 9,884. April 27th.

Prepayment Mechanism for Use in Connection with Renting or Hire Purchase of Electric Installations or other Standing Charges in Connection Therewith. F. H. Merritt. 10,462. May 4th.

Automatic Switch for Preventing Excessive Current in Electric Motors and Circuits in which a Variable Electric Current Flows. A. Stewart. 10,467. May 4th.

Generators, Converters and Alternate-Current Motors. V. A. Fynn. 11,298. May 14th.

Block Signal Systems for Railways and the like. British Thomson-Houston Co. (General Electric Co.) 11,497. May 16th.

Electric Heating and Cooking Apparatus. R. H. Cripps. 13,032. June 5th.

Ignition Devices of the Class Known as Cigar Lighters. J. G. Tournier. 15,230. July 4th. (Date applied for under International Convention, September 25th, 1905.)

Electric Fuse-Boxes. H. J. Herberts and C. A. Herberts. 18,086. August 11th.

Operation of Electric Clocks by means of Electrical Waves. M. Reithoffer and F. Moraweiz. 18,829. August 22nd.

Galvanic Cells. H. P. R. L. Pörscke. 21,348. September 26th.

Meters for Electricity, Gas and the like. Allgemeine Elektricitäts Ges 29,201. December 21st. (Date applied for under International Convention December 28th, 1905.)

1907.

Frictional Igniter for Miners' Safety Lamps. P. Wolf. 3,835. February 15th.

Manufacture of Electric Incandescence Filaments from Tungsten or Mixtures Thereof with other Metals. Siemens & Halske Akt.-Ges. 4,814. February 27th. (Date applied for under International Convention, March 10th, 1906.)

Electric Furnaces. Allmänna Svenska Elektriska Aktiebolaget. 5,345. March 5th. (Date applied for under International Convention, March 7th, 1906.)

The McDonald Electrolyser.—Particulars are to hand from two American sources respecting a new electrolyser for the production of chlorine and caustic soda. Neither is very full of information, and even read conjointly, they still leave a number of unanswered questions of wide general interest. Attention must first be given to an article by Mr. J. R. Crocker in the February issue of *Electro-chemical and Metallurgical Industry*, which describes the plant installed at the New York and Pennsylvania Co.'s Paper Mill, at Johnsonburg, Pa. This has been in operation for over a year, and is rated as having a daily capacity of 16 tons of bleaching powder and 6½ tons of caustic soda. The electrical plant installed comprises direct-current compound-wound dynamos giving 2,000 amperes at from 180 to 270 volts, direct-coupled to vertical compound condensing motors. The chlorine gas is led away not to a lime chamber but to a chlorination tower, where it comes into contact with a milk of lime solution, forming a solution of calcium hypochlorite. It may be inferred that a diaphragm process is in use, as the caustic soda solution produced is taken to an evaporator for concentration and salt elimination. After eight months working the anodes had to be replaced. The other information bearing upon the subject is to be found in a paper contributed to *Technology Quarterly* by Messrs. E. B. Phelps and W. T. Carpenter, which states that the yield of available chlorine by this electrolyser is 0·46 lb. of chlorine per kilowatt-hour. As a yield this is in no way remarkable, having been exceeded by several English processes.